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ABSTRACT

This document presents the proceedings of the International Academy for Information Management's International Conference on Informatics Education and Research (ICIER), held December 14-16, 2001 in New Orleans, Louisiana. The keynote address was given by Joseph A. Grace, Jr., founding and current President of the Louisiana Technology Council. Presentations include: "Who do we need to motivate? Toward an Integrative Model of E-education" (Celia Romm, Arik Ragowsky); "Technology for Managing Professional Knowledge of Future Software Developers" (Aybuke Aurum); "Student Learning Styles & Distance Learning" (Raymond Papp); "From Distance Education to Flexible Learning"(Tim S Roberts); "Application Of A Model For Improving ICT Management: A Case Study" (Gregory Wanyembi); "RoboCup: Multi-disciplinary Senior Design Project" (Kevin Lee Elder, Lonnie R. Welch, David M. Chelberg, Douglas A. Lawrence, Jae Y. Lew, Robert L. Williams II.); "Cultural and Gender Issues In The Computer and Information Technology Curriculum" (Mary J. Granger, Joyce Currie Little, Susan K. Lippert); "Effective Case Study Methodologies In The Management Of IT Courses" (James R. Buffington, Jeffrey S. Harper); "Teaching With Online Case Studies: Implementation And Evaluation Issues" (Roberto Vinaja, Mahesh S. Raisinghani); "Using the Web as a Strategic Resource: An Applied Classroom Exercise" (Kathleen M. Wright, Mary J. Granger); "A Hierarchy of Needs for a Virtual Class" (Catherine Beise, Judy Wynekoop); "Development Of An E-Commerce Model Curriculum" (Dwayne Whitten, Charlotte Stephens); "Aligning E-Business Programs with Industry Needs" (Keng Siau, Sid Davis, Kumar Dhenuvakonda); "Preparing For Information Systems Accreditation" (Doris K. Lidtke, John Gorgone, David Feinstein); "A Strategy to Overcome Challenges in Teaching an Introductory MIS Course" (Aileen Cater-Steel, Ee Kuan Low, Rohan Genrich); "Teaching Data Warehousing to Graduate Students-A Case Study" (M.C. Matthee, H.L. Viktor, J. Pretorius, E. Venter); "End User Support as a Result of Computing Education" (Susan E. Yager, John F. Schrage); "Teaching the Evaluation of Electronic Commerce Sites Using HCI Techniques" (Carina de Villiers); "A Survey of Database Curricula Using Web-Posted Syllabi" (Joseph T. Harder); "Requiring Students To Bring Computers To Campus: Are Universities Achieving Their Goals?" (Cindy H. Randall, Barbara A. Price); "Implementing a 'Third Place' for MIS Students: Preliminary Report" (Lori Baker-Eveleth, Suprateek Sarker, Daniel Eveleth); "Comparing the Expectations of Information

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Technology Students to the Expectations of Graduates" (Pat Hodd, Brian Dobing); "Students' Perception of PBL Assessment" (Ahmad Ghafarian, Willie Yip); "Comparison of Live Versus Paper-Based Assessment in Computer Application Courses" (Nicole B. Koppel, Kimberly A. Killmer); "Telematic Education in Informatics: A Case Study of the Pitfalls and the Challenges" (A.C. Leonard, W.M. Motha); "Predicting Physicians' Intentions To Adopt Internet-Based Health Applications: A Field Study Utilizing The Extended Technology Acceptance Model" (Sonja Wiley-Patton, William Chismar); "An Exploratory Study Of The Structure And Activities Of MIS Advisory Boards" (James R. Buffington, Dennis Bialaszewski, Janejira Sutanonpaiboon); "Analyzing the Factors that Affect Intention to Enter a Post Baccalaureate Business Education Program" (Richard McCarthy, George Claffey); "Adopting Distance Education - What do the Students Think?" (Geoffrey N. Dick, Tom Case, O. Maxie Burns); "SERVQUAL-Based Measurement of Student Satisfaction with Classroom Instructional Technologies: A 2001 Update" (Betty A. Kleen, L. Wayne Shell); "A Framework for Controlling Cheating in IS Education" (James R. Coakley, Craig K. Tyran); "Pre-training Motivation to Learn: Construct Exploration in an Information Systems Context" (Cynthia LeRouge, Creggan Gjestland, Ellis Blanton; "A Finance Application Of Information Technology" (Thomas Pencek, Lisa MacLean); "Tutorial for A Framework to Introduce the Extensible Markup Language (XML) into Information Systems Coursework" (Meg Murray, Stephanie Cupp); "Using IT to Teach Project Management in the MBA Core" (Ali Jenzarli); "E-Business And The Global Adaptation Of MBA Programs" (Harald Mahrer, Roman Brandtweiner); "What Makes Distributed Learning Effective?" (Thomas L. Case, Diane Fischer, Muhammadou M. O. Kah, Carol Okolica, Raymond Papp); "Alpha Iota Mu presentation" (Learn about the new Information Systems & Technology honor society) (James R. Buffington, Brent L. Bacon); "A Comparison of Business and Game Projects For Intermediate Programming Classes" (Brian Dobing, David Erbach)"Programming Languages for Teaching Object-Orientation" (Michael A. Eierman); "Knowledge Sharing Tools and the Facilitation of Student Team Performance in IS Courses" (Seokwoo Song, Thomas Case); and others. (MES)

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Proceedings of the International Academy for Information Management (IAIM) Annual Conference: International Conference on Informatics Education & Research (ICIER)(16th, New Orleans, Louisiana, December 14-16, 2001)

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International Academy for Information Management's

International Conference on Informatics Education & Research

December 14-16, 2001
New Orleans, Louisiana

Friday December 14

Opening Reception (6:00 pm – 8:30 pm)

Saturday December 15

Keynote Address (8:00 am – 9:30 am)
Sessions 1A – 1D (9:45 am – 10:45 am)
Sessions 2A - 2D (11:00 am – 12:00 am)
Sessions 3A - 3D (1:45 pm – 2:45 pm)
Sessions 4A - 4D (3:00 pm – 4:00 pm)
Sessions 5A - 5D (4:15 pm – 5:15 pm)

Sunday December 16

Sessions 6A - 6D (9:00 am - 10:00 am)
Sessions 7A- 7D (10:30 am - 12:00 pm)
Session 8 - Joint IAIM/ICIS (12:30 pm – 1:30 pm)

Author Contact Information

Friday, December 14

IAIM Board Meeting (9:00 A.M. – 6:00 P.M.) Mayor's Chambers

Opening Reception (6:00 – 8:30 P.M.) Explorers Room

Saturday, December 15

Breakfast Buffet (7:30 – 8:30) Bayou Lobby

Keynote Address (8:00 – 9:30)

(Bayou 1 & 3)

Joseph A. Grace, Jr. is the founding and current President of the Louisiana Technology Council. Joe is a 1980 graduate of the United States Naval Academy and a former Nuclear Submarine Officer. He comes from a well-established Louisiana family and spent most of his early years overseas where his father was in the Diplomatic Corps as a Naval Attaché. After leaving the Navy in 1988, Joe toured as a musician and recording artist before "getting a real job" with a Fortune 500 Electronics firm in California, where he held various positions in sales and sales management. He came home to Louisiana in November of 1994 to assume the position as President and develop the New Orleans Technology Council. He is fully committed to transforming the Louisiana Technology industry and serves on multiple Boards and committees throughout the State.

Sessions 1A-1D (9:45 - 10:45)

1A – Pedagogical Issues I (Bayou 1)
SESSION CHAIR: Diane Fischer, Dowling College

"Who do we need to motivate? Toward an Integrative Model of E-education"
Celia Romm, Central Queensland University, and Arik Ragowsky, Wayne State University.

"Technology for Managing Professional Knowledge of Future Software Developers"
Aybuke Aurum, University of New South Wales.

1B – Internet/Distance Education I (Bayou 2)
SESSION CHAIR: Mary Brabston, The University of Manitoba

"Student Learning Styles & Distance Learning"
Raymond Papp, University of Tampa.

"From Distance Education to Flexible Learning"
Tim S Roberts, Central Queensland University.

1C – Curriculum Issues I (Bayou 3)
SESSION CHAIR: Jim Buffington, Indiana State University

"Application Of A Model For Improving ICT Management: A Case Study"
Gregory Wanyembi, Delft University of Technology.

"RoboCup: Multi-disciplinary Senior Design Project"
Kevin Lee Elder, Lonnie R. Welch, David M. Chelberg and Douglas A. Lawrence, Jae Y. Lew and Robert L. Williams II.

1D – PANEL Presentation (Bayou 4)
SESSION CHAIR: Mary Granger, George Washington University

"Cultural and Gender Issues In The Computer and Information Technology Curriculum"
Mary J. Granger, George Washington University, Joyce Currie Little, Towson University, and Susan K. Lippert, George Washington University.

Sessions 2A-2D (11:00 – 12:00)

2A – Pedagogical Issues II (Bayou 1)
SESSION CHAIR: Max Burns, Georgia Southern University
"Effective Case Study Methodologies In The Management Of IT Courses"
James R. Buffington, and Jeffrey S. Harper, Indiana State University.

"Teaching With Online Case Studies: Implementation And Evaluation Issues"
Roberto Vinaja, University of Texas Pan American, and Mahesh S. Raisinghani, University of Dallas.

2B – Internet/Distance Education II (Bayou 2)
SESSION CHAIR: Cindy Randall, Georgia Southern University

"Using the Web as a Strategic Resource: An Applied Classroom Exercise"
Kathleen M. Wright, Salisbury State University, and Mary J. Granger, George Washington University.

"A Hierarchy of Needs for a Virtual Class"
Catherine Beise, and Judy Wynekoop, Florida Gulf Coast University.

2C – Curriculum Issues II (Bayou 3)
SESSION CHAIR: Celia Romm, Central Queensland University

"Development Of An E-Commerce Model Curriculum"
Dwayne Whitten, Ouachita Baptist University, and Charlotte Stephens, Louisiana Tech University.

"Aligning E-Business Programs with Industry Needs"
Keng Siau, Sid Davis, and Kumar Dhenuvakonda, University of Nebraska –Lincoln.

2D – PANEL Presentation (Bayou 4)
SESSION CHAIR: Doris Lidtke, Towson State

"Preparing For Information Systems Accreditation"
Doris K. Lidtke, Towson University, John Gorgone, Bentley College, and David Feinstein, University of South Alabama.

Luncheon & Annual Meeting (12:00 – 1:30) Bailey Room

Sessions 3A-3D (1:45 – 2:45)

3A – Pedagogical Issues III (Bayou 1)
SESSION CHAIR: Geoffrey Dick, University of New South Wales

"A Strategy to Overcome Challenges in Teaching an Introductory MIS Course"
Aileen Cater-Steel, Ee Kuan Low, and Rohan Genrich, University of Southern Queensland, Australia.

"Teaching Data Warehousing to Graduate Students – A Case Study"
MC Matthee, HL Viktor, J Pretorius and E Venter, University of Pretoria.

3B – Internet/Distance Education III (Bayou 2)
SESSION CHAIR: Tom Schambach, Illinois State University

"End User Support as a Result of Computing Education"
Susan E. Yager and John F. Schrage, Southern Illinois University.

"Teaching the evaluation of Electronic Commerce sites using HCI techniques"
Carina de Villiers, University of Pretoria.

3C – Curriculum Issues III (Bayou 3)
SESSION CHAIR: Charlotte Stephens, Columbus State University

"A Survey of Database Curricula Using Web-Posted Syllabi"
Joseph T. Harder, Indiana State University.

"Requiring Students To Bring Computers To Campus: Are Universities Achieving Their Goals?"
Cindy H. Randall, and Barbara A. Price, Georgia Southern University.

3D – Best Paper Finalists I (Bayou 4)
SESSION CHAIR: Tom Pencek, Meredith College

"Implementing a 'Third Place' for MIS Students: A Preliminary Report"
Lori Baker-Eveleth, Washington State University, Suprateek Sarker, Washington State University, and Daniel Eveleth, University of Idaho.

"Comparing the Expectations of Information Technology Students to the Expectations of Graduates"
Pat Hodd, and Brian Dobing, University of Lethbridge.

Sessions 4A-4D (3:00 – 4:00)

4A – Pedagogical Issues IV (Bayou 1)
SESSION CHAIR: Camille Rogers, Georgia Southern University

"Students' Perception of PBL Assessment"
Ahmad Ghafarian, North Georgia College & State University & Willie Yip, The Hong Kong Polytechnic University.

"Comparison of Live Versus Paper-Based Assessment in Computer Application Courses"
Nicole B. Koppel, and Kimberly A. Killmer, Montclair State University.

4B – Internet/Distance Education IV (Bayou 2)
SESSION CHAIR: Susan Lippert, Drexel University

"Telematic Education in Informatics: A case study of the pitfalls and the challenges"
A.C (Awie) Leonard, and WM (Wayne) Motha. University of Pretoria.

"Predicting Physicians' Intentions To Adopt Internet-Based Health Applications: A Field Study Utilizing The Extended Technology Acceptance Model"
Sonja Wiley-Patton, and William Chismar, University of Hawaii Manoa.

4C – Curriculum Issues IV (Bayou 3)
SESSION CHAIR: Ali Jenzarli, University of Tampa

"An Exploratory Study Of The Structure And Activities Of MIS Advisory Boards"
James R. Buffington, Dennis Bialaszewski, and Janejira Sutanonpaiboon, Indiana State University.

"Analyzing the Factors that Affect Intention to Enter a Post Baccalaureate Business Education Program"
Richard McCarthy, Quinnipiac University, and George Claffey, Central Connecticut State University.

4D – Best Paper Finalists II (Bayou 4)
SESSION CHAIR: James Coakley, Oregon State University

"Adopting Distance Education – What do the Students Think?"
Geoffrey N. Dick, University of New South Wales, Tom Case, Georgia Southern University, and O. Maxie Burns, Georgia Southern University.

"SERVQUAL-Based Measurement of Student Satisfaction with Classroom Instructional Technologies: A

2001 Update"
Betty A. Kleen and L. Wayne Shell, Nicholls State University.

Sessions 5A-5D (4:15 – 5:15)

5A – Pedagogical Issues V (Bayou 1)
SESSION CHAIR: Richard McCarthy, Quinnipiac University

"A Framework for Controlling Cheating in IS Education"
James R. Coakley and Craig K. Tyran, Oregon State University.

"Pre-training Motivation to Learn: Construct Exploration in an Information Systems Context"
Cynthia LeRouge, University of South Florida, Creggan Gjestland, University of Alabama, and Ellis Blanton, University of South Florida.

5B – Internet/Distance Education V (Bayou 2)
SESSION CHAIR: Marianne D'Onofrio, Central Connecticut State University

"A Finance Application Of Information Technology"
Thomas Pencek, Meredith College, and Lisa MacLean Wentworth Institute of Technology.

"Tutorial for A Framework to Introduce the Extensible Markup Language (XML) into Information Systems Coursework"
Meg Murray and Stephanie Cupp, Kennesaw State University.

5C – Curriculum Issues V (Bayou 3)
SESSION CHAIR: Stephanie Huneycutt, Christopher Newport University

"Using IT to Teach Project Management in the MBA Core"
Ali Jenzarli, University of Tampa.

"E-Business And The Global Adaptation Of MBA Programs"
Harald Mahrer and Roman Brandtweiner, Vienna University of Economics and Business Administration.

5D – PANEL: Distance Learning (Bayou 4)
SESSION CHAIR: Raymond Papp, University of Tampa

"What Makes Distributed Learning Effective?"
Tom Case Georgia, Southern University, Diane Fischer, Dowling College, Muhammadou M.O. Kah, Rutgers University, Carol Okolica, Dowling College, and Raymond Papp, University of Tampa.

Saturday Post-Session (5:30-6:00)
Bayou 1

"Alpha Iota Mu presentation" (Learn about the new Information Systems & Technology honor society)
James R. Buffington & Brent L. Bacon, Indiana State University.

Sunday, December 16

Breakfast Buffet (8:00 – 9:00) Bayou Lobby

Sessions 6A-6D (9:00 – 10:00)

6A – Programming Issues (Bayou 1)
SESSION CHAIR: Behrooz Seyed-Abbassi, University of North Florida

"A Comparison of Business and Game Projects For Intermediate Programming Classes"
Brian Dobing, University of Lethbridge, and David Erbach, Purdue University - Fort Wayne.

"Programming Languages for Teaching Object-Orientation"
Michael A. Eierman, University of Wisconsin Oshkosh .

6B – Knowledge Sharing (Bayou 2)
SESSION CHAIR: Marianne D'Onofrio, Central Connecticut State University

"Knowledge sharing tools and the facilitation of student team performance in IS courses"
Seokwoo Song and Thomas Case, Georgia Southern University.

"A Committee-Based Model for Supporting Organizational Knowledge Management"
Les L. Miller* and Sree Nilakanta, Iowa State University.

6C – Collaborative Learning (Bayou 3)
SESSION CHAIR: Tom Case, Georgia Southern University

"Collaborative Learning and Group Assessment: Introducing the Capitalist and Socialist Paradigms"
Tim S Roberts, Central Queensland University.

"A Meta-Analysis of Research on Student Team Effectiveness: A Proposed Application of Phased Interventions"
Charlotte S. Stephens, Louisiana Tech University.

6D – PANEL Presentation (Bayou 4)
SESSION CHAIR: Patricia Sendall, Merrimack College

"A Comparison of E-Commerce and Information Systems Job Types: Is There a Difference?"
Patricia Sendall, Merrimack College, and Herbert E. Longenecker, Jr., University of South Alabama.

Sessions 7A-7C (10:30 – 12:00)

7A – Social Issues (Bayou 1)
SESSION CHAIR: Seokwoo Song, Georgia Southern University

"Social Issues and e-Business"
Candance Deans, Thunderbird -- the American Graduate School of International Management
Paul Ulrickson, Consultant/Relationship Coach

7B – Potpourri Issues (Bayou 2)
SESSION CHAIR: Betty Kleen, Nicholls State University

"Enterprise Resource Planning Systems: Factors Affecting Implementation"
Carol Okolica, Dowling College.

"Interested in Improving: Your Teaching, Student Placement, Opportunities for Applied Research, Practical Knowledge, Professional Network and External Financial Out Reach?"
Rick Weible, Marshall University.

"Developing a Robust System for Effective Teamwork on Lengthy, Complex Tasks: An Empirical Exploration of Interventions to Increase Team Effectiveness"
Charlotte S. Stephens, Louisiana Tech University, and Martha E. Myers, Kennesaw State University.

7C – Table Topics I (Bayou 3)
SESSION CHAIR: Brian Dobing, University of Lethbridge

"The MFC Framework as a Case Study on Effective Object-Oriented Design"
Yonglei Tao, Grand Valley State University.

"Trials and Tribulations of Updating an IS Curriculum"
Behrooz Seyed-Abbassi, University of North Florida.

"The Employment Out Look for Information Technology Workers: A Demand Forecast"
Rick Weible, Marshall University.

"An Approach To Teaching Information Technology And System Architectures"
Annette Lerine Steenkamp, University of Detroit Mercy.

"The Internet and Intellectual Property Rights: What Business Managers and Business Majors Need to Know"
Carol Okolica, Dowling College and Laurette D. Mulry, Legal Aid Society.

7D – Table Topics II (Bayou 4)
SESSION CHAIR: Seokwoo Song, Georgia Southern University

"Systems Development Practices: Circa 2001"
Thomas Schambach and Kent Walstrom, Illinois State University.

"Changing Trends In Corporate Education: Impacting University Education?"
Abdus Sami Nagi and Mary J. Granger, George Washington University.

"Be Prepared for the Working Environment – Teamwork for Information Systems Students"
Gys le Roux, Pieter Joubert, University of Pretoria.

"Leveraging Mobile Technology for m-Learning: 3rd Generation Threaded Discussions"
Timothy R. Hill, San Jose State University.

"Accommodating Accounting Majors in a Required CIS Beginning Programming Course. Approach and Results"

David V. Beard, Kenneth J. Trimmer, Mark A. Bezik, Kenneth A. Smith, Idaho State University.

Session 8 (12:30 – 1:30)

8 – Joint IAIM/ICIS Curriculum Presentation (Bayou 1)
SESSION CHAIR: Raymond Papp, University of Tampa

"IS 2002: An Update of the Information Systems Model Curriculum"
Herbert E. Longenecker, Jr., University of South Alabama, David L. Feinstein, University of South Alabama, Gordon B. Davis, University of Minnesota, John T. Gorgone, Bentley College, and Joe Valacich, University of Washington.

We hope you will join us for ICIER 2002 next December 13-15, 2002 in Barcelona, Spain

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International Academy for Information Management

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WHO DO WE NEED TO MOTIVATE? TOWARD AN INTEGRATIVE MODEL OF E-EDUCATION

Celia Romm
Central Queensland University

Arik Ragowsky
Wayne State University

ABSTRACT

This paper starts from the premise that to be effective, e-education has to be intrinsically motivating. However, in contrast to much of the literature in the field, which focuses almost exclusively on the needs of students, the paper discusses THREE groups of stake holders whose concerns and motivation have to be considered: students, instructors, and institutions. Following a critical review of the literature on e-education, which highlights some of the major themes that have attracted research so far, we proceed to introduce a model that integrates the needs of the above three stakeholders. The model is followed with a description of the Radical Model, an innovative approach to e-education that is an example of applying the proposed model in practice. We conclude with a discussion of the research implications from the model.

INTRODUCTION

In a recent editorial (Emurian, 2001, pp 3-5), the author hails e-education as a revolution that would make the dream of "management of individual differences among learners" come true. In his editorial, the author lists a number of rhetorical questions that relate to the issues that he believes will be addressed by the advent of e-education, including:

1. Where is it written that the pace of life must be controlled by an academic institution?
2. Where is it written that a course grade must be frozen in time for ever?
3. Where is it written that a student must be limited to a single evaluation occasion, without the opportunity for additional learning to achieve an intellectual criterion of excellence?
4. Where is it written that the scale of an intellectual unit must be a traditional semester long course?

The above questions reflect a series of issues that are of importance to students and that e-education could address. Once these issues are addressed through the design of courses that can be started and finished at any time and assessment procedures that allow students to repeat tasks indefinitely, the end result could, indeed, be a highly individualised learning experience for students. But is this what e-education is about, particularly in the context of universities?

The underlying premise of this paper is that this is not the case. In order for e-education to succeed it has to cater to THREE stake holders and not just one. Creating an environment that is motivating to students is one of the major objectives of any educational technology. However, for such a technology to be sustained over time, it has to be intrinsically motivating to those who manage it (instructors) and those who resource it (institutions). Following a critical review of the literature on e-education, which highlights some of the themes that have been emphasised by previous research to date, we proceed to introduce a model that integrates the needs of students, instructors and institutions. The model is followed with a case study that details the Radical Model, an innovative approach to e-education that is an example of applying the model in practice. We conclude with a discussion of the research implications from the model.

LITERATURE REVIEW

The literature on e-education to date seems to emphasise a number of themes. Following is a short review of these themes.

First, there seems to be a debate over the TYPES of approaches to on-line teaching. One of the central models in this area, the Typology of Dispersion (Johansen, 1992), differentiates between on-line teaching that occurs at the same place and at the same time (Synchronous/Proximate), teaching that occurs at the same time but in different places (Anytime/Virtual), teaching that occurs at the same place but at different times (Synchronous/Dispersed), and teaching that occurs at different times and different places (Asynchronous/Dispersed). Other writings discuss specific technologies that can support the various teaching situations in the above model, such as presentation technologies (Leidner and Jarvenpaa, 1995) to support the same time/same place teaching, video conferencing to support same time/different place teaching (Alavi, Wheeler, and Valacich, 1995), Web page presentation, e-mail and other Internet based technologies to support different time and different place teaching (Chizmar and Williams, 1996; Kuecheler, 1999).

Second, there is a growing literature on underlying PHILOSOPHY of on-line teaching. One of the central models in this area, the Dimensions of Learning Theories approach, has been proposed by Leidner and Jarvenpaa (1995). The model differentiates between two broad philosophies of teaching. Objectivism, which holds that learning occurs in response to an external stimulus, and constructivism, which holds that knowledge is created in the mind of the learner. As a result, while the objectivism approach would lead to learning situations where knowledge is "delivered" to passive learners by an active instructor, the constructivist philosophy would result in learning situations where active learners create knowledge through interaction with each other.

There is an emerging body of literature that looks at the implications of this model to on-line teaching (Passerini and Granger, 2000). The findings from this research seem to suggest that the objectivist approach does not result in significant benefits, namely, there are no significant differences between face to face and videoconference lectures (Alavi, Yoo and Vogel, 1997) and there are no significant differences between web site and audio supported learning and face to face learning (LaRose, Gregg and Eastin, 1998) However, the constructivist approach does seem to have relative benefits in that GSS supported classes seem to do better than face to face ones (Alavi, 1994), particularly in areas relating to critical thinking (Alavi, Wheeler and Valacich, 1995). Interestingly, while the quality of learning for the IT supported students seems to be about the same as for the face-to-face ones, they appear to be less satisfied with the learning experience (Ocker and Yaverbaum, 1999).

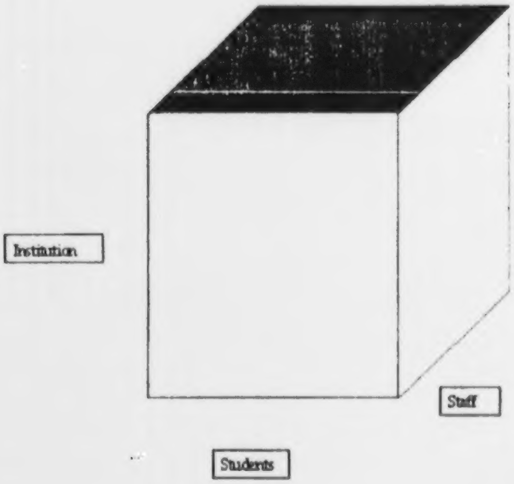
Finally, a third prominent theme in the literature on e-education is the discussion of its STRCTRAL antecedents. Here we find, on one hand the claim that e-education is a necessary evil imposed on universities because of declining resources and the necessity to reduce costs and expand markets (Alavi, Yoo and Vogel, 1997) and on the other the fear that once universities embrace this innovation, it could result with a "second rate" education for students and a transformation of university instructors from creators of new knowledge (researchers) into assembly line labourers, delivering educational services to masses of virtual students (Klor de Alva, 2000).

TOWARD AN INTEGRATIVE MODEL OF E-EDUCATION

The above review suggests a need for integration of what appears to be several distinct bodies of research. While the first body of research, on the technologies that support e-education, is important in terms of understanding the tools that can be applied in this area, and while the second body of research, on the underlying philosophies of e-education, can help assess the effectiveness and efficiency of e-education in terms of how it meets a given set of goals, both bodies of research are student centred in that they focus primarily on the needs of students.

What is currently lacking in the literature is more emphasis on the needs of the two other stake-holders in the e-education game, namely, instructors and institutions. Figure 1 presents a pictorial depiction of the three dimensional integrative model that we are proposing as a basis for a future research agenda in this area. The three dimensions of the model reflect the motivational needs of students, instructors and institutions that are yet to be described.

FIGURE 1
INTEGRATIVE MODEL FOR E-EDUCATION



The following are some issues that, based on current research, are likely to emerge as motivating factors for the three stake-holders and that could be the content of future versions of the proposed integrative model.

Students

Some of the issues that are likely to motivate students to engage in e-learning are the perception that this experience has resulted in the acquisition of relevant knowledge and skills, satisfaction with the interaction with the instructor and other students during the learning process, receipt of ample amounts of feedback on progress, and the receipt of an a fair grade at the end of the course.

Instructors

Some of the issues that are likely to motivate instructors to engage in e-learning are the perception that this experience has resulted in an enhancement of the instructors knowledge and skills, satisfaction with the interaction between the instructor and the students during the learning process, the perception of the effort invested in the teaching of course as reasonable, the perception that the instructor receives appropriate recognition and rewards for his/her investment in e-education.

Institutions

Some of the issues that are likely to motivate instructors to engage in e-learning are the perception that the institution is likely to gain from investing in this innovation, satisfaction with the process of changing the organization to one that engages in e-learning, once it has been undertaken, the perception that e-learning is cost-effective, the perception that the organization is likely to benefit from the investment in e-education in future.

APPLYING THE INTEGRATIVE MODEL IN PRACTICE

In the following sections we discuss an approach to e-education that is currently applied for a range of courses (Cook and Veach, 1997, Romm and Taylor, 2000, Roberts, Jones and Romm, 2000) at Central Queensland University, Australia, including small post-graduate courses (with up to 20 students) and large under-graduate courses (with up to 100 students). The students are a combination of on-campus and distant learners, with both groups treated as one homogenous class.

To date, this approach has been used to teach courses in Management of Information Systems and Electronic Commerce. Student responses to this approach have been very positive. One indication of this is that the two elective courses that which pioneered this approach on a large have gone up from zero to over 300 students in just about two years.

The teaching materials for this approach (irrespective of what area is being taught) include:

- A video which contains detailed explanations on how the course is run;

- A ten-page booklet "Course Outline" which describes all necessary information about the course (it is available on line as part of the course's Web site and is provided to the students on a CD ROM and on hard copy);

- A textbook; and

- A class e-mail list.

The first thing that students do once they read the course outline and watch the video is subscribe to the class e-mail list. They then introduce themselves to the class on-line so they can be divided into weekly presentation groups. The allocation to groups is completed by the second week of the semester. By this time, students are expected to establish contact with their virtual group members and start working on their assessment tasks. On week 3 of the semester, the first group makes its presentation to the class on-line. The presentation consists of an article (which the students have to enclose, attach, or simply establish a hyper-link to) and a critique that links the article with the reading in the book for the week.

The presentation is made on Monday of each week. By Friday, each of the groups in the class is expected to comment on the presentation. On Sunday, the presentations for the week are read by the instructor along with the comments that were made by all the groups. All groups are marked every week for either their presentation or their comments about other students' presentations. This procedure is repeated for ten weeks up until the end of the semester, with each week dedicated to an in-depth discussion of a **different** topic that is related to the reading for that week.

The students' mark for the course consists of 50% group mark for their performance in the group and 50% an individual exam. To make sure that students do not take advantage of their group membership, all groups are invited to submit a consensus opinion of their members. Students are told right at the beginning of the semester that if the members of a particular group are in agreement that one member did NOT pull his or her weight, the mark of that student can be reduced by 10 points.

To conclude:

The Radical Model makes efficient use of the students' interactions with each other. Even though, students have some private interaction with the lecturer ("one to one") and some interaction as a group, when the lecturer communicates with them on the class list ("one to many"), the bulk of their interactions in this approach is in the "many to many" mode, with the other students in their presentation groups and with the rest of the students in the class through the class e-mail list.

Throughout the semester, students are assessed on 11 assessment tasks (including their group presentation, comments on other students' presentations and an end of term exam). In a class of 100, they get 18 comments that represent the views of their own group members (nine members), as well as nine group comments representing the other 90 students in the class. Since this procedure is repeated every week, the students can receive over 100 unit of inputs from their group members, the other groups, and from the lecturer by the end of the semester. Note, that most of the feedback on one's performance comes from the OTHER students - not the lecturer.

It should be noted that even though class interaction is the means through which teaching takes place, the Radical Model does not result in the list being flooded by e-mail messages. As indicated in the previous sections, students are instructed to refrain from using the class list for unlimited expression. The place for such interaction is supposed to be the small presentation groups that they establish to support their group work. The messages that end up being posted on the class list are messages from the list moderator (the lecturer) "formal" presentations of the students' work, and comments by the other groups about these presentations.

The Radical Model helps develop students' communication and other "soft skills." In addition to learning about the content area for the semester, students learn important on-line skills such as how to set up their e-mail lists, how to be citizens of an on-line community, and how to contribute to a virtual team, including dividing the work between the team members, resolving conflicts, developing ideas and projects, and providing positive feedback to others about their work.

Through the involvement of students from diverse backgrounds (many of whom are fully employed) students learn about how organizations use the abstract concepts that are mentioned in the readings. They also learn about relevant legislation and ethical issues.

The Radical Model is "flexible" for both the instructor and the students. This approach increases flexibility for students, because the students don't have to submit hard copy assignments (hence, nothing can get lost through the system). They get to know if their submission was successful immediately when they see it posted on the class list. As well as this, if something happens to preclude an individual student's contribution during the semester, time out and compensation work can be negotiated within groups. In fact, students don't need to ever negotiate with the lecturer on late submission, special consideration, etc. All negotiations on these issues are carried out within the group.

Students have further flexibility in not having to download large amounts of data from the class Web site (there is nothing on the web site other than the Course Outline). They don't need to buy any books other than the course textbook, and even this book can be shared between them up until the end of the semester, as all assessment tasks are group based. Because all learning is facilitated by the class list, the students can engage in class activities from home, work, or while travelling. Further flexibility to the students is provided through the students' selection of supplementary readings for class discussion by **themselves**. As a result, students get to read quite a large number of articles on topical issues that are of interest to them rather than forced to read articles selected by the instructor.

Lecturer flexibility is also an enormous advantage of the radical model. Since the package for this course does not include a Study Guide, there is no need to update one every semester. Since the course is in no way dependent on a textbook, there is no need to modify or change it in any way if and when there is a need to change a textbook. In fact, preparing study materials for a new semester should not take more than a few minutes, given that nothing substantial has to change.

As for on-going teaching; reading the weekly presentation and the comments by the other groups (students are restricted to two pages or two screens maximum per critique or comment on other people's critique), takes two to three hours per week. This can be done from anywhere, including from home or from a conference. Theoretically, even if the lecturer is totally incapacitated, another person can easily take over and do the on-going weekly assessment, without inconveniencing the students.

Note that this design is also advantageous from a legal perspective. Since articles by other authors are not used as part of the course Web site, there is no infringement on other people's copy-rights.

The most important aspect about this model is that no matter how many students are in the class, the amount of work for the lecturer is the **same!!** No matter how many students are in the class, 10 or 100, the lecturer ends up checking 10 presentations of one page each per week for ten weeks. If the class consists of 10 students, these 10 pages of text represent the work of each of them. If the class consists of 100 students, the ten pages will represent the work of the ten groups into which the students have been divided. Thus, the amount of semester marking for the lecturer remains the same, irrespective of the number of students in the class.

WHY IS THE RADICAL APPROACH AN APPLICATION OF THE INTEGRATIVE MODEL?

It is our belief that the Radical Model works because it represents an integration of the three components of the Integrative E-education model. To demonstrate this point, we would like to go back to the issues that were mentioned previously as contributing to the motivation of the three stake-holders to engage in e-education.

Students

The Radical approach is motivating to students because in addition to acquisition of relevant knowledge and skills, they also receive large amount of feedback from the instructor and their fellow students. Because of its "constructivist" philosophy, the model is also associated with ample opportunities for interaction between the students and the instructor and among the students. Since 50% of the mark in this course is based on an individual exam, the students feel that their efforts both as individuals and as a group are acknowledged and fairly rewarded.

Instructors

Instructors are motivated to use this approach because by allowing the students to "create" the course (through selection of the weekly readings and leadership of the class discussion), there is an opportunity for instructors to expand their knowledge and skills as a result of teaching the course. Since most of the administrative issues that are associated with the teaching of the course (handling late submissions, appeals, etc) are resolved

WITHIN the groups without any input from the instructor, the overall experience of interacting with the class is exceptionally positive for the instructor. Since students are basically teaching each other, the effort that is involved in teaching the class is minimal, hence contributing the perception of instructors that they are not investing in the virtual class more time and effort than they would in a face to face class.

Institutions

The above case did not elaborate on the organisational context of the Radical Approach. However, from the list of tools that are used to support this approach, it is clear that this approach involves minimal investment on the part of the institution (the only requirement is to establish an e-mail list and have the students subscribe to the list). At least from this perspective, this approach can be seen as highly cost-effective for institutions, and, as such, highly motivating.

RESEARCH AGENDA EMANATING FROM THE INTEGRATIVE MODEL

The underlying premise of this paper, that the success of e-learning should be assessed in terms of its motivating potential to students, instructors, and institutions could be researched in the following ways.

1. **Outcomes**. Future research could compare different on-line teaching styles in terms of their effect on outcome variables such students, instructors and institutional satisfaction, quality of the learning process, etc. Once undertaken, such research could determine empirically the dynamics between the three stake-holders that produces successful e-learning.

2. **Process**. An analysis of the interactions in the on-line class and in organizations that use e-education on a large scale, particularly from a qualitative longitudinal perspective, can reveal patterns of communication and group dynamics that are typical of effective versus ineffective e-education environments.

3. **Antecedents**. The effect of a range of moderating variables on both the outcome and the process of effective e-education can be explored. Mediating variables could include: demographic variables (gender, age, socio-economic class, ethnicity), attitudinal variables (learning style, preference to work in the distant mode), institutional variables (course, program studied) and global variables (national culture). All these variables should, of course, be explored in terms of their effect on the perceptions of members of all three stake-holder groups.

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TECHNOLOGY FOR MANAGING PROFESSIONAL KNOWLEDGE OF FUTURE SOFTWARE DEVELOPERS

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ABSTRACT

This paper proposes and empirically tests a specific knowledge management technology aimed at stimulating creative and innovative performance of students in software development courses. The technology is based on a solo brainstorming method that provides students with external stimuli and exposes them to a large number of ideas over a short period of time. An empirical test was conducted using 16 volunteer student subjects. It reveals a highly beneficial effect of the technology on the participants' ability to specify requirements for a new software product. In particular, interaction with the technology resulted in a significant increase in the total number of ideas generated by the participants, as well as the number of relevant categories of issues addressed. These results suggest that the technology may be useful in facilitating learning and performance in informatics subjects involving creative thinking and problem solving.

INTRODUCTION

There is a widespread recognition in the business literature that creativity and innovation are the major sources of the economic growth and competitive advantage of today's organisations (Drucker, 1985; Satzinger et al., 1999; Tomas, 1999). It is therefore not surprising that surveys show that these two issues are among the top priorities for senior executives in industry today (BW, 1998). There is also an acknowledgement that software has emerged as central to all sophisticated innovations (Quinn et al., 1997). In many cases, software is the end product itself, or it is the highest value component in the end product. This is true for most of the fastest growing industries including computer, entertainment, communications, advertising, logistics and financial services. In other cases, software facilitates most stages of the value creation and innovation processes.

The changing economic landscape, particularly the growing importance of software-based innovations, suggests the need for better management of professional knowledge of future software developers. This, in turn, requires an appropriate response from education and training institutions. The purpose of this study is to address the issue of creativity and innovation by describing and testing a specific educational technology aimed at stimulating creative thinking and idea generation of students in software development courses.

Creativity can be defined as the production of novel and appropriate ideas, solutions and work processes (Shalley and Perry-Smith, 2001). While newness and novelty are the key dimensions of creative expressions, appropriateness is also an essential requirement in the context of problem solving and innovation. Generally, the education sector should nurture creativity, so that students can be successful in their future roles as innovative professionals and business people. More specifically, it is of utmost importance that informatics students be given an opportunity to develop and apply creative and innovative skills to software processes and products.

Some theorists believe that creativity is reserved only for the gifted, while others see it as a skill that can be learned (Ford, 1996; Marakas, 1998). We see creativity as a property of a thought process that can be acquired through instruction and practice. Therefore, the main objective of this study is to: (i) describe a specific technology based on a brainstorming method as a potentially suitable tool for stimulating informatics students' creative thinking and idea generation, and (ii) test empirically the effectiveness of the technology in enhancing students' creative performance in the context of a requirements specification for a new software product, in particular an information system.

TECHNOLOGY DESCRIPTION

There are various types of knowledge management tools available for supporting different stages of the knowledge management process. According to Wensley (2000), the majority of these tools are useful in two ways: they may assist in making tacit knowledge explicit and they may be used to encode explicit knowledge. The technology in this study is fundamentally different, as it aims at supporting knowledge creation rather than facilitation of knowledge transfer through externalisation and codification.

The technology is based on a solo brainstorming method. This is an individual brainstorming technique in which the participant interacts with a set of documents and identifies issues from these. Typically, the brainstorming session includes reading and editing of stimulating material, typing a summary of the documents, making lateral comments and nominating issues from them to be followed up (Aurum, 1997, 1999). The protocol encourages lateral thinking and brings a formal setting to the process of issue identification. It also incorporates Osborn's (1957) four basic brainstorming rules: no criticism is allowed while interacting with documents, freewheeling is welcome, quantity is wanted, and combination and improvement are sought. Earlier, the method has been successfully applied in a number of decision making tasks (Aurum, 1997; Aurum and Martin, 1999). This suggests that the technology based on solo brainstorming may be useful in stimulating the creative thinking of students in software development tasks, particularly in the requirements specification phase.

Essentially, the technology provides support for the following activities:

(i) Documenting the requirements that students considered relevant to the given software development task. These were the issues that they were aware of before interacting with the stimulating material;

(ii) Interacting with a series of documents one at a time, and noting issues as they arose or new ideas as they were generated. The intention was to capture users' reasoning, opinions, knowledge and lateral thoughts which went into their reaction to the stimuli. In this way, users could more confidently approach the task of identifying issues and generating ideas;

(iii) Documenting ideas that occurred to students after interacting with the documents. The objective was to enable users to express their ideas, comments and knowledge, combined with the data that they interacted with. Since users were presented with a copy of their comments from the interaction, they could go through the comments and identify the relevant issues.

The technology also incorporates a set of stimulating documents as primary external information sources regarding cultural heritage of Australia. These included abstracts of journal and conference papers which were retrieved from bibliographic databases. It was expected that the subjects would explore the given problem from many different angles by restructuring and rearranging information available in the abstracts and combining them with their expertise. It was also important not to prejudge while interacting with abstracts. The critical aspect was to prevent brainstorming from a prejudgement of an issue set that was relevant. Therefore, sometimes abstracts addressed general issues, in which case the specifics of the local case (Australia) had to be considered by the participants. Sometimes, experiences from Venice in Italy or from Louvre museum in Paris, France were not expected to be relevant to Australian situation at all. In any case, the role of these documents was to trigger ideas.

It was also expected that in this interactive environment the notions given in abstracts would prompt recognition and processing by individuals. Previous experience and expertise were also considered important. The responses could come from direct reactions as well as stimulated recollections. These were both potentially valuable. The intention was to tease out such reactions to the full. These principles are assumed to be valuable for any situation in which creative and innovative ideas are desirable. In order to maintain this atmosphere, during the interaction stage, the subjects were required to follow the brainstorming protocol.

In developing the technology, a particular attention was also paid to designing the interface. It was important to prevent substantial cognitive resources being diverted from the task in response to demands from the user-interface. The aim was to produce an interface that would have minimal impact on cognitive load, one which could be learned easily by a novice user and yet was comprehensive enough to satisfy the experienced user (Aurum et al., 1995).

EMPIRICAL TEST

The technology was empirically tested in a simulated business situation based on Collins et al. (1996). It involved a fictitious organisation, The Cultural Heritage Authority, whose job was to coordinate the marketing of cultural heritage in Australia. Subjects adopted the role of user/developer working for the authority. Their task was to generate ideas with respect to the anticipated requirements for the authority's new software-based marketing system. During the task performance, the subjects were required to produce two sets of documents: one before and one after interacting with the technology provided to aid their task. Before interaction, subjects were asked to identify and record a range of potential issues they believed were important for marketing of cultural heritage in Australia based solely on their past knowledge and experience. Then, they were asked to interact with the technology and edit and read all available material. After reading and editing each abstract, the subjects were required to produce a second written document, identifying additional issues and adding commentary notes.

A total of 16 subjects participated in the study on a voluntary basis. The participants were drawn from the pool of graduate students attending courses in software development process at the large Australian university. Each received a monetary incentive of $45 for their participation. The experimental session was conducted in a microcomputer laboratory. On arrival, subjects were seated at individual workstations and worked alone. They received instructions regarding the case study and task requirements. They also had an opportunity for practice prior to commencing the experiment and for asking questions during the experiment. The session lasted 3 hours.

Subjects' accomplishment in the task was evaluated in terms of the total number of relevant ideas generated (denoted *total ideas)*, as well as the number of relevant categories of issues addressed (out of 19) as assessed by an expert judge (denoted *total categories)*. The judge was a software developer with over 30 years of experience. The judge examined students' ideas for relevance and assigned them to appropriate categories and sub-categories. The classification scheme enabled examination of the changes in the quantity, as well as the quality of ideas generated by the students due to technology use.

RESULTS

In order to understand the effects of the technology on individual participants' creative performance we analysed statistically the changes in the number and nature of ideas generated 'after' the interaction with the technology compared to those 'before.' The paired T-test was selected as the most suitable method for the analysis (Huck et al., 1974). Results of the analysis are shown in Table 1.

Overall, the results of the analysis performed indicate a significant positive impact of the technology on both the quantitative and qualitative aspects of the participants' creative performance. Table 1 shows significant effects on both dependent variables of performance, total ideas and total categories.

With respect to the quantitative aspect of performance, the results indicate a highly significant positive impact of technology on total number of relevant ideas generated by the participants. As shown in Table 1, there was a significant increase in the number of relevant ideas generated due to using the technology. More specifically, the mean value for total ideas increased by 9.50, from 7.69 before to 17.19 after the interaction ($p < 0.001$).

More interestingly, the results indicate a highly significant positive impact of technology on the qualitative aspect of participants' performance. Table 1

TABLE 1
RESULTS OF PAIRED T-TEST ANALYSES ON DEPENDANT VARIABLES OF PARTICIPANTS' PERFORMANCE

Dependent Variable Tested	Unit of Measurement	Mean Value Before Interaction	Mean Value After Interaction	Direction and Amount of Change	Significance of Change (p value)
Total Ideas	Number	7.69	17.19	+9.50	0.000*
Total Categories	Number (%)	4.31 (23)	8.25 (43)	+3.94 (+20)	0.000*

*p < 0.001

shows that there was a significant increase in the number of relevant categories addressed by the participants as a result of their use of the technology. The mean number of different categories addressed expanded on average by 3.94 (or 20 %), from 4.31 (or 23%) before to 8.25 (or 43%) after the interaction with the technology (p < 0.001).

DISCUSSION

The experimental results clearly indicate that a solo-brainstorming based technology had a powerful effect on students' creative performance in the software requirements specification task. The effect was evident in both the quantitative and qualitative aspects of the performance evaluated. Users were found to generate significantly greater number of relevant ideas, as well as address a significantly greater number of relevant categories of issues as the result of their interaction with the technology.

The results of this study provide substantial support for the view that creative performance can be enhanced by appropriate instruction, as suggested by some theorists (Ford, 1996; Marakas, 1998). The instructional technology studied here was found to contribute to a significant improvement in both the quantity and quality of ideas generated by the participating students. These results also agree with our earlier findings from an empirical study conducted in the decision making context (Aurum et al., 2001). Essentially, the results support the idea that thinking applications can be developed, learnt, practiced and used to generate ideas. Thus, they can enable an individual to think, provided that the principles are clearly understood.

It has also been suggested in the literature (Satzinger et al., 1999) that the idea generation method is one of the most important sources of encouraging creativity. The results of our study indicate that the brainstorming technique underlying our instructional technology was a highly appropriate method for stimulating creative thinking and idea generation in a software development task. Students were found to generate a significantly greater number and variety of relevant system requirements ideas after than before a solo-brainstorming session. Essentially, the session helped students uncover ideas without being constrained, stimulate their own thinking by external influences and capture all of their thoughts.

The findings of the study also support the proposition that an electronic tool following a specific creativity technique can assist the creative process (Sridhar, 2001). One of the main advantages of such a tool is the speed at which ideas can be produced. Furthermore, the ideas can be stored and revisited at the later time. The tool can also provide a variety of stimuli that enhance imagination. The electronic technology implemented in this study provided all of the above, plus a written protocol that brought a formal structure to the idea generation process.

Our findings may have some important implications for the education sector. Generally, they suggest that the education sector first needs to acknowledge the importance of teaching students how to think creatively. Then, it needs to implement courses whose purpose is to prepare students for the knowledge based economy. It appears that some governments and institutions are starting to emphasise the significance of promoting creative thinking of young through education

(Sunderland, 2000) and are beginning to implement changes in courses taught in business schools (Sangran, 2001). The results of this study suggest that the instructional technology tested here may be a useful teaching tool in a variety of courses involving creative thinking and problem solving. They also suggest that it is likely to be most valuable in situations where the problem is unstructured, goals indistinct, and the outcome of an action cannot always be clearly identified. The tool is a rather generic one, since it uses a technique that can be applied to a variety of scenarios and can help people process relevant documents whilst identifying issues. These documents act like a 'trigger' to stimulate domain specific ideas from users.

While the current study provides a number of interesting findings, some caution is necessary regarding their generalisability due to a number of limiting factors. The application of laboratory conditions is a limitation of this study. We believe that in field work, the users' individual achievements would improve even further. We also speculate that the performance of users in an interaction session can be affected by their state of mind or previous experience. In some cases, the user may already be 'aware' of the requirements and may have the desire to look for some particular aspects rather than identifying issues in general. There may also be other situations where the user may only want to see what the literature is about but not be interested in identifying any requirements. In such cases, the user will act differently in the course of interaction with the abstracts. The emphasis of the present study was on individual students. It would be interesting to examine the effect of the technology on creative performance of groups. Future research may address some of these issues.

CONCLUSION

This study proposed and empirically tested a specific technology for stimulating creative problem solving of software developers. The technology was designed on the basis of a solo brainstorming technique. The essence of tool was to provide users with external stimuli and expose them to a large number of ideas over a short period of time. The tool was tested in the context of software requirements specification task. The results of the test indicated that the tool was quite helpful. Users were able to improve their creative performance and generate greater number of relevant ideas and address a more relevant categories of requirements. Future research is recommended to address current study limitations.

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STUDENT LEARNING STYLES & DISTANCE LEARNING

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ABSTRACT

Distance learning is quickly becoming an accepted and even necessary part of college and university programs. As more colleges and universities join the growing ranks of institutions offering distance learning, educators and administrators are struggling with the issue of how to assess student success in this new and largely untested environment. Many distance learning providers, and even some institutions, have developed short surveys that are designed to gauge whether a student is prepared to undertake distance learning. These tests, however, may not accurately assess a student's predisposition and learning style. This paper highlights and compares the use of different learning style inventories as a means to formally and empirically assess learning styles. Students in both distance learning and traditional classroom courses were given several of these inventories and their progress was tracked. Initial results indicate that some of these can be used as a successful predictor of student performance and may be useful for students and administrators in determining whether or not the student should undertake a distance learning course or program. The paper concludes with some suggestions and implications for educators on distance learning.

INTRODUCTION

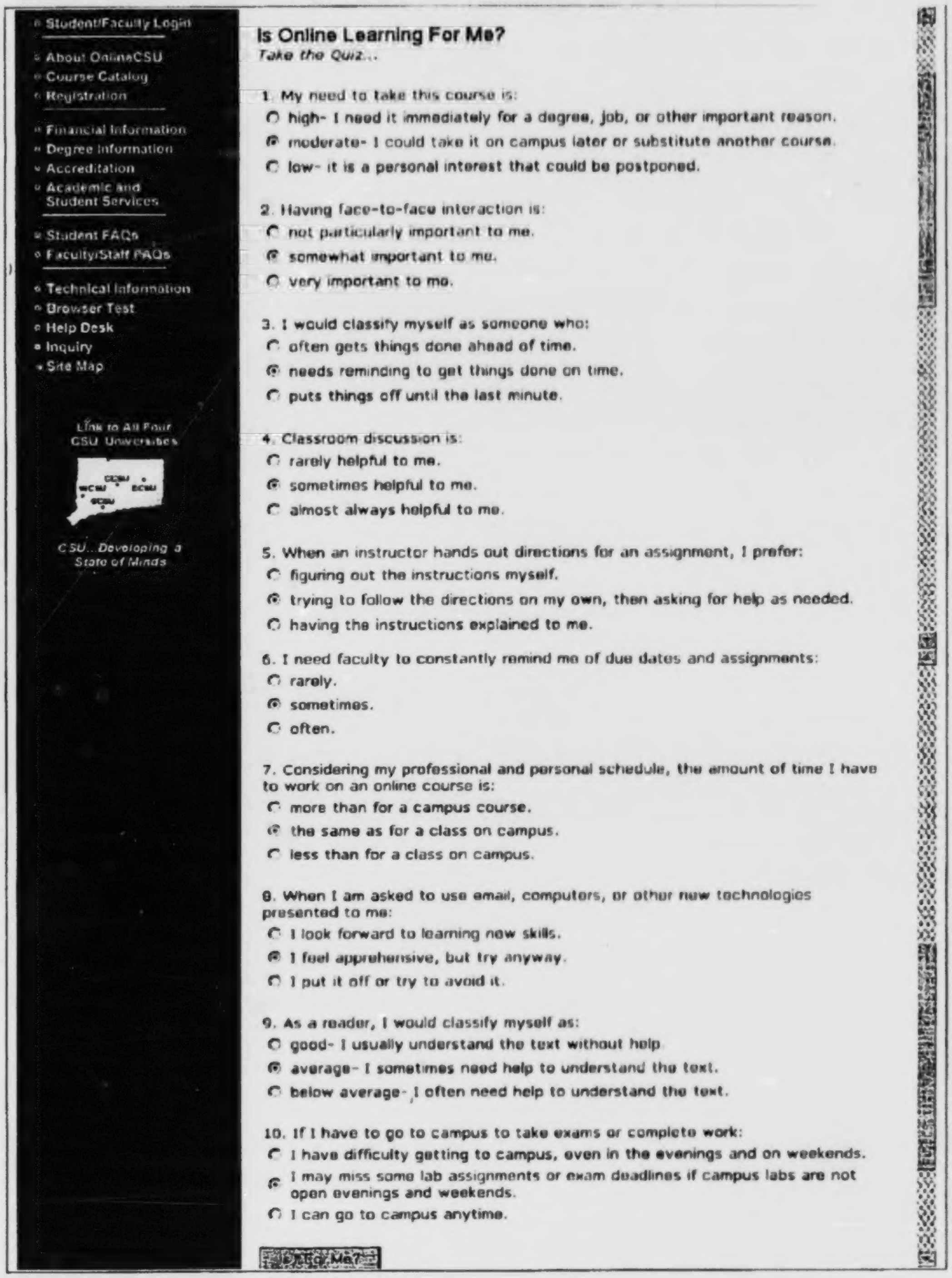
Distance learning has become an established, accepted part of many college and university offerings and, in some cases, represents a major portion of the curricula. Given the technological advances and broad reach of the Internet, this is not surprising. Students and administrators alike are demanding such programs given the changing student demographics and societal needs. As the traditional college populations change, the need for programs which address convenient, flexible, and adaptable learning increases. Life-long learning and re-tooling also necessitate programs which can accommodate full-time workers and those with familial obligations. Need notwithstanding, distance learning providers have not spent much time investigating whether or not this new pedagogy is suitable for everyone and how to assess who might benefit from it.

Many institutions offer distance-learning courses and/or programs but have little or no pre-assessment for students. They feel that the need for such courses and programs is justified, however they often do not provide a way for prospective students to assess their level of readiness for such programs. This is especially true for those students who have been away from the classroom environment for some time and are now returning to continue a course of study or re-tool in a new area. This paper begins with an exploration of some of the ways in which students are currently tested, highlights and compares several different learning style inventories, and presents initial findings from both on-campus and on-line classes with respect to student learning styles. It concludes with general suggestions for educators and administrators on how to assess student readiness for this new environment. Future research will gather data from a much larger population to assess which learning style assessment, if any, is most suitable for assessing student readiness for this new and largely unexplored pedagogy.

EXISTING ASSESSMENTS

A few of the commercial distance learning providers have developed their own self-assessment surveys or questionnaires to assist students in deciding whether or not to undertake a distance learning course or program.

Some are very short, others are more comprehensive and thorough. For example, one of the providers, eCollege™, uses a short 10-question quiz to assess potential student success (http://www.onlinecsu.ctstateu.edu/index.real?action=IsOnline).


Student/Faculty Login
About OnlineCSU
Course Catalog
Registration
Financial Information
Degree Information
Accreditation
Academic and Student Services
Student FAQs
Faculty/Staff FAQs
Technical Information
Browser Test
Help Desk
Inquiry
Site Map
Link to All Four CSU Universities
CCSU
WCSU
ECSU
SCSU
CSU...Developing a State of Minds
For Me?

Is Online Learning For Me?
Take the Quiz...

1. My need to take this course is:
○ high- I need it immediately for a degree, job, or other important reason.
● moderate- I could take it on campus later or substitute another course.
○ low- it is a personal interest that could be postponed.

2. Having face-to-face interaction is:
○ not particularly important to me.
● somewhat important to me.
○ very important to me.

3. I would classify myself as someone who:
○ often gets things done ahead of time.
● needs reminding to get things done on time.
○ puts things off until the last minute.

4. Classroom discussion is:
○ rarely helpful to me.
● sometimes helpful to me.
○ almost always helpful to me.

5. When an instructor hands out directions for an assignment, I prefer:
○ figuring out the instructions myself.
● trying to follow the directions on my own, then asking for help as needed.
○ having the instructions explained to me.

6. I need faculty to constantly remind me of due dates and assignments:
○ rarely.
● sometimes.
○ often.

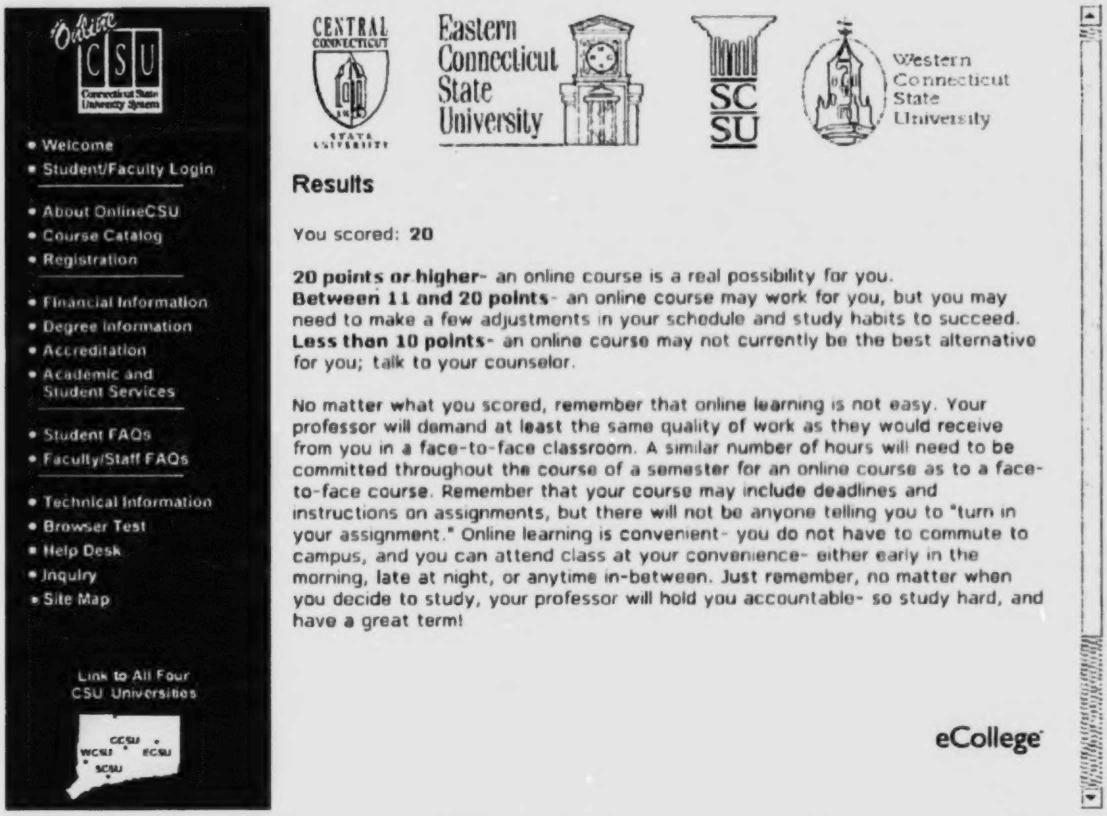
7. Considering my professional and personal schedule, the amount of time I have to work on an online course is:
○ more than for a campus course.
● the same as for a class on campus.
○ less than for a class on campus.

8. When I am asked to use email, computers, or other new technologies presented to me:
○ I look forward to learning new skills.
● I feel apprehensive, but try anyway.
○ I put it off or try to avoid it.

9. As a reader, I would classify myself as:
○ good- I usually understand the text without help
● average- I sometimes need help to understand the text.
○ below average- I often need help to understand the text.

10. If I have to go to campus to take exams or complete work:
○ I have difficulty getting to campus, even in the evenings and on weekends.
● I may miss some lab assignments or exam deadlines if campus labs are not open evenings and weekends.
○ I can go to campus anytime.

The results of the exam, given a "middle of the road" set of responses as indicated above, are:


Online CSU
Connecticut State University System
Welcome
Student/Faculty Login
About OnlineCSU
Course Catalog
Registration
Financial Information
Degree Information
Accreditation
Academic and Student Services
Student FAQs
Faculty/Staff FAQs
Technical Information
Browser Test
Help Desk
Inquiry
Site Map
Link to All Four CSU Universities
CCSU
WCSU
ECSU
SCSU
Central Connecticut State University
Eastern Connecticut State University
SCSU
Western Connecticut State University
eCollege

Results

You scored: **20**

20 points or higher- an online course is a real possibility for you.
Between 11 and 20 points- an online course may work for you, but you may need to make a few adjustments in your schedule and study habits to succeed.
Less than 10 points- an online course may not currently be the best alternative for you; talk to your counselor.

No matter what you scored, remember that online learning is not easy. Your professor will demand at least the same quality of work as they would receive from you in a face-to-face classroom. A similar number of hours will need to be committed throughout the course of a semester for an online course as to a face-to-face course. Remember that your course may include deadlines and instructions on assignments, but there will not be anyone telling you to "turn in your assignment." Online learning is convenient- you do not have to commute to campus, and you can attend class at your convenience- either early in the morning, late at night, or anytime in-between. Just remember, no matter when you decide to study, your professor will hold you accountable- so study hard, and have a great term!

(http://www.onlinecsu.ctstateu.edu/index.real?action=IsOnline)

ANALYSIS

While the results may be helpful to a student, the point system illustrated above is vague and a variation on only one or two answers could result in a recommendation against distance learning. While the eCollege™ survey is easy to take, the accuracy of the results might be questionable in that students are not asked specific questions about their learning styles but rather more about the environment (e.g., their level of comfort with technology, ability to visit campus, and/or need for contact with the instructor).

It is interesting to note that as of mid-2001, national institutions such as the University of Phoenix™, Jones International University™ and Western Governors University™ do not offer any type of pre-assessment. They encourage the student to enroll and work with a counselor and/or technical support personnel to bring them up to speed in their environment. This is a common approach, but one that may subject the student to unnecessary stress as they attempt to work out their difficulties and determine the suitability of a distributed learning environment.

So how does a student determine if he/she will be successful in a distance-learning environment? They could enroll in one of these national or local institutions and "learn the ropes" and hope that they will be able to handle the rigors of learning without the benefit of an actual classroom setting. For older students and those who already have substantial work experience and/or a previous degree, this may not be a difficult adaptation. Students who will potentially require more assistance are those whose learning styles may not be amenable to a non-classroom setting. Local and regional institutions in particular may target their own students or those in the local area rather than a national or international clientele. It is for these institutions that a more comprehensive assessment of learning style is beneficial (Sternberg, & Grigorenko, 1997).

OVERVIEW OF LEARNING INVENTORIES

There are numerous learning style assessments currently available. Some were designed for learning assessment in general while others have been adapted or modified to accommodate many of the newer learning styles and pedagogies.

One of the oldest and most well known ways of assigning students to a given learning style is that of Kolb's (1984) Learning Style Inventory (LSI). This assessment inventory consists of 36 words in 9 groupings of 4 each. The student is asked to rank each of the sets of words on a 1 to 4 scale, with 1 equating to least like the person, 4 being the most like the person. The four columns of words correspond to four learning style scales: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Kolb uses Jung's (1977) typologies as the main foundation in the development of these learning styles. For example, the abstract conceptualization (AC) style "focuses on using logic, ideas, and concepts. It emphasizes thinking as opposed to feeling" while the concrete experimentation (CE) style "focuses on being involved in experiences and dealing with human situations in a personal way. It emphasizes feeling as opposed to thinking" (Kolb, 1984, 68-69).

Kolb's LSI has been criticized for its low reliability and validity measures (Freeman & Stumpf, 1978; Holman, Pavlice & Thorpe, 1997; Lamb & Certo, 1978; West, 1982), yet it has received equal support as a way of illustrating the different approaches to learning (Abbey et al, 1985; Kruzich et al, 1986; Nulty & Barrett, 1996; Raschick et al, 1998). As a result of the diverse opinions and findings, other methodologies are needed to provide a more stable platform with respect to validity and reliability of such an assessment. Other methodologies which will be included in this investigation include Tait and Entwistle's ASSIST (1996), Solomon and Felder's (1996) Index of Learning Styles (ILS), Honey and Mumford's (1992) Learning Styles Questionnaire (LSQ) and the Academic Self-Efficacy Scale (Eachus, 1993).

The ASSIST (Approaches and Study Skills Inventory for Students) instrument developed by Tait and Entwistle (1996) is a 38-item inventory which attempts to identify students with weak study strategies. It has four subscales which measure four approaches of studying and academic aptitude. The scales are deep (intention to understand, relation of ideas, active learning), surface (intention to reproduce, unrelated memorizing, passive learning), strategic (study organization, time management, intention to excel), and apathetic (lack of direction and interest). Students respond to items relating to each of these approaches along a five-point likert scale from "agree" to "disagree". A score for each of the approaches is determined by summing the scores from each of the items corresponding to each subscale.

Solomon and Felder's (1996) Index of Learning Styles (ILS), originally developed for engineering students, focuses on four bi-polar preference for learning scales. These include Active-Reflective, Sensing-Intuitive, Visual-Verbal, and Sequential-Global (Felder & Silverman, 1988). Active learners are those who learn by trying things and working with others. Reflective learners prefer to think things through and work alone. Sensing learners are oriented toward facts and procedures while Intuitive learners are more conceptual, innovative and focus on theories and meanings. Visual learners prefer visual representations of material such as pictures, diagrams and charts while verbal learners prefer written or spoken explanations. Sequential learners are linear and orderly in their thinking and learn in small incremental steps while Global learners are holistic thinkers who learn in large leaps. These bi-polar scales offer a good basis for comparison of learning types.

The Learning Styles Questionnaire (LSQ) developed by Honey and Mumford (1992) identifies four types of learners, Activists (e.g. enjoy new experiences, make intuitive decisions, dislike structure), Theorists (e.g. focus on ideas, logic and systematic planning, mistrust intuition), Pragmatists (e.g. favor practical approaches, group work, debate, risk-taking), and Reflectors (e.g. observe and describe, try to predict outcomes, try to understand meaning). According to the authors, individuals tend to rely on one of these approaches when they are engaged in learning.

Finally, the Academic Self-Efficacy Scale (Eachus, 1993) is a 23-item scale which assesses the extent to which students believe they have the ability to exert control over their academic environment. By totaling the scores from the items, a self-efficacy score can be determined. This can be useful for students to determine the extent to which a distance-learning environment will be suitable for them. By knowing their level of self-efficacy, they will be in a better position to make a decision as to whether or not to pursue a more traditional course of study.

METHODOLOGY & PRELIMINARY RESULTS

Each of the assessment inventories highlighted above were administered to students in an on-campus sophomore level computer class focusing on hardware, software and networking. The same inventories were administered to students in a distance-learning course conducted during the summer of 2001. The course covered the same content as the on-campus course, but was delivered entirely over the Internet.

Preliminary analysis regarding each of the learning styles is presented below. A total of 40 students took part in this pilot study. 25 took the traditional on-campus class and 15 took the distance-learning class over the summer. The mean age was 19 for the on-campus class and 20 for the distance-learning class. There were 15 women and 10 men in the on-campus section and 11 men and 4 women in the on-line section. All were classified as full-time students although 80% reported working at least 20 hours per week while they took the courses. It must be noted here that this small sample size prevents the results that follow from being generalized to the general population. It is the author's intention to undertake a full study given the promising results of this initial pilot study.

Kolb categorizes four learning styles: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Analysis of the sample indicates that 75% of the students responded as Abstract Conceptualizers (AC) and 85% classified themselves as Active Experimenters (AE). Given the subject of the course, computer hardware and software, this is not surprising. It is interesting to note that more women (13%) then men (7%) categorized themselves as Reflective Observers (RO). This might be indicative of male-female personality differences, but this cannot be verified given the sample.

Analysis of Tait and Entwistle's (1996) ASSIST (Approaches and Study Skills Inventory for Students) instrument indicates that men (12%) are more inclined to be surface learners (e.g. more passive and inclined to memorize) than women (8%). Women outnumber men almost two-to-one in terms of deep (active learning, idea relation) learning (28% to 15%). Few students indicated an apathetic learning style and most were highly focused on strategic learning. Incidentally, this focus was much more pronounced in the on-line class (82%) than in the on-campus class (68%), possibly suggesting a greater need for time management and organization. This may have been the result, however of the shortened (six-week) class time period.

Solomon and Felder's (1996) Index of Learning Styles (ILS) focuses on four bi-polar scales. Active Learners try things out and prefer working with others while Reflective learners prefer to work alone and think things through. Students in both classes were largely Reflective learners, however this may be the result of their age and lack of experience with group settings. Sensing learners are more fact-oriented and Intuitive learners are more conceptual. Not surprisingly, students were more Sensing (87%) than Intuitive (56%), probably a result of their chosen major, computer information systems. People with an aptitude toward computers tend to be sensing and thinking which is in line with the Myers-Briggs Type Indicator. Students were also more Visual (92%) then Verbal (8%). This may be largely the result of age. Generation Y has grown up in a much more visually-oriented world and results may differ greatly if the population were not so homogeneous. Also not surprising is the all the students identified as being Sequential learners. This again may be a direct result of age.

The Learning Styles Questionnaire (LSQ) developed by Honey and Mumford (1992) identifies four types of learners: Activists, Theorists, Pragmatists, and Reflectors. Students identified largely as Theorists (72%) and to a lesser degree as Reflectors (15%). This may be the result of their level of learning—this was a sophomore class and students at this level are not required nor have they developed skills in group dynamics and intuitive decision-making. Honey and Mumford indicate that individuals tend to rely on one of these approaches when they are engaged in learning. This seems to hold true here.

Eachus' (1993) Academic Self-Efficacy Scale assesses the extent to which students believe they have the ability to exert control over their academic environment. Students' scores were all across the board here, some being very high and others relatively low. There does not seem to be a pattern with respect to gender or course section. The small sample size may be a deciding factor and a larger sample size is needed to better understand the implications of self-efficacy.

Thus, from this preliminary analysis we find that there are some scales that seem to better predict learning outcome than others. Solomon and Felder's (1996) Index of Learning Styles (ILS) seems to have more consistent and applicable predictive value than the other scales. Kolb's (1984) Learning Style Inventory also seems to shed some light on which learning style is more prevalent in distance learning. The results of this pilot study suggest that a larger sample might be useful in determining whether or not these scales do indeed predict learning outcomes. Correlation with students' final grades might be even more of a significant factor. A follow-up study will be done to determine the effects of grade on learning style.

IMPLICATIONS FOR EDUCATORS

Given the sheer number of students who anticipate taking or are currently taking distance-learning courses, the need to be able to quickly and easily assess their potential level of success in these courses is paramount. Simply because it is an available alternative to the traditional classroom does not make it a viable option for everyone. Students have specialized needs and skills and not every student may be suited to a distance-learning environment. It is the responsibility of educators to make sure that students know and understand the risks and potential drawbacks to this environment. The last thing we want is for a student to be "lost in cyberspace" when a simple assessment early on might have identified the student as a poor candidate for distance learning. Regardless of the attractiveness and profitability of this new pedagogy, we must still be available for our students and provide them with every opportunity to further their education as they go forward on their journey in today's fast paced digital world.

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FROM DISTANCE EDUCATION TO FLEXIBLE LEARNING

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ABSTRACT

Many educational institutions have recently started to move some of their course materials online, and then used the terms "flexible delivery" or "flexiblelearning" both in their everyday discussions and in their promotional literature. However, the use of asynchronous learning technologies does not of itself make for true flexibility in learning. In almost all cases, the flexibility extends to location only. In very few cases does the flexibility extend to the method of learning or the order of the material to be studied; and in almost none does the flexibility extend to any temporal aspects.

This paper suggests some ways forward for institutions seeking to make their courses truly flexible.

INTRODUCTION

A large number of universities and other educational institutions have recently been moving their course materials online, so that they may be used as the foundations for courses being undertaken by students remote from the campus, or by on-campus students as a supplement to face-to-face sessions, or a combination of both. More often than not these institutions will then use the terms "flexible delivery" or "flexible learning" both in their everyday discussions and in their promotional literature. However, the use of asynchronous learning techniques, such as placing notes on the Web, or arranging for the use of electronic discussion lists, does not make for true flexibility in learning. In almost all cases, the flexibility will be in location only; that is, the students are enabled to access the materials from anywhere with good internet connections. In very few cases does the flexibility extend to the method of learning or the order of the material to be studied; and in almost none does the flexibility extend to any temporal aspects. Students must still enrol at a certain (often inconvenient) time, take assessment items at a certain (often inconvenient) time, and complete their study at a certain (often inconvenient) time.

And yet skills such as walking, or swimming, or driving, or playing chess, are all learnt without such fixed constraints. Indeed, in almost no other aspects of human learning, except for courses at recognized academic institutions, are such strict temporal limitations imposed.

What does it mean for an institution to offer truly flexible learning? How does that differ from current practice? And what are the major obstacles that need to be overcome?

CURRENT MODELS OF FLEXIBLE DELIVERY

At its most minimal, the term flexible delivery can be taken to mean any form of delivery where students have a choice of study mode. This could mean, for example, that students are enabled to study from a distance via the provision of printed materials.

More recently, the term has been used to describe almost any course that utilizes advanced learning technologies. For example, four examples of models of web-based delivery that are in current use for the delivery of computer science or information system courses have been described in [1].

In the most minimalist of these four models, the naïve model, face-to-face lecture notes are placed online; the course is then considered "flexible" in the sense that distance education students have access not only to predistributed printed materials but also to online lecture notes.

Even with the other three more sophisticated models, (the standard model, the evolutionary model [3], and the radical model [4], [5]), flexibility is enabled only in the sense that students unable to attend on-campus lectures and tutorials have a range of varied web-based facilities and email-based discussion groups to assist them to learn, and to enable greater interaction, both with the instructors and with other students.

Occasionally institutions have experimented with the design and implementation of courses including a wider definition of flexibility; in almost all cases, however, the experiments tend to have been with a single course, with a limited number of students, and limited scope [2].

So we must ask the question, to what extent are such models as those described above, and others like them, truly flexible? The current author has proposed a possible classification scheme for flexible learning, which would seem to indicate that most current courses do not rate very highly [6].

LIMITATIONS OF CURRENT MODELS

While all of the models described above do indeed enable students physically situated at remote locations to study courses via the internet, true flexibility is denied because (a) students still have to abide by a fixed method of study, (b) students still have to study the course materials in a particular order, and (c) students still have to abide by administrative timelines decided by the institution.

Why Do Students Have to Abide by a Fixed Method of Study?

The reasons here are primarily economic—to provide a variety of possible modes of study requires greater investment in time and materials. Giving students the choice of individual or group work, or learning from different texts, or (to take an extreme case) learning programming while allowing a choice of different programming language, has in the past been seen as just too hard and just too expensive.

Why Do the Course Materials Have to Be Studied in a Particular Order?

On occasion, this is because the nature of the material is such that concepts build one upon the other, and the particular sequence is largely determined by the nature of the material itself (for example, it may be thought desirable to learn about the properties of concrete before learning how to design concrete structures). However, more often the primary reason for a particular order is not the increasing complexity of the material, but rather the need to learn according to the order of the quizzes, tests, and other assessment items that are presented through the course (there is little point in learning about programming principles in week one and design principles in week two if the test on design occurs at the end of week one and the test on programming occurs at the end of week two).

Why Do Institutions Have So Many Administrative Timelines?

This is the primary obstruction to true flexibility, and here the primary reasons are many and complex—they would include reasons that are primarily historical, cultural, political, and economic. And, in large part, institutions in many countries are hamstrung by bureaucratic government regulations that require the reporting of detailed statistics, where the models used assume fixed timelines for enrolment, withdrawal, and completion.

TOWARDS TRUE FLEXIBLE LEARNING

In a learning environment which seeks to be truly flexible, students should be able to enroll when they want, study from any location at times of their own choosing, take assessment items when they feel they are ready, and complete as soon as they are able.

For this to become a reality, all of the obstacles detailed in the earlier sections need to be overcome. Most educational institutions are, by nature, fairly conservative and resistant to change. However, the rewards for those able to adapt themselves to the new environment are potentially large. So how should universities seeking to make their courses as flexible as possible set about making the necessary changes?

The following steps are seen to be essential.

- a rationalization in the modes of course delivery
- a comprehensive redesign of course materials
- a revision of the types of assessment used
- a change to institutional timelines

These four steps will be dealt with separately. None of the four are without difficulties.

A Rationalization in the Modes of Course Delivery

No institution seeking to compete in the modern global environment can afford to provide courses in three completely different formats, yet that is precisely what many have chosen to do by default. Where once courses were provided only face-to-face, the need to attract distance education students has meant delivery also by means of printed materials; and the advent of the internet has meant delivery also online.

As a result, the same lecture will often be delivered to one group of students in a live session by an instructor; again in printed form prepared prior to the start of the semester; and yet again in the form of an html page or a pdf document provided online via the Internet.

This is, of course, not cost-effective. For the institution seeking maximum flexibility at a reasonable cost, the first two of these methods should be dispensed with, and all efforts put into effective and comprehensive delivery of the material online.

Instructors will need to be available on a continuous basis. Thus, rather than having the responsibility for one or two courses per semester, in the new flexible environment it may be that an instructor has overall responsibility for one course for an extended period, perhaps even two to three years. The instructor can expect to have to field questions and comments from students continuously throughout this period.

A Comprehensive Redesign of Course Materials

Face-to-face sessions are necessarily sequential in nature. Printed chapters in a book are sequential too, but at least here the adventurous reader can skip ahead.

No medium is better suited to a variety of possible orders than the Internet, with its built-in hyperlinks. Students are easily enabled to study the material in an order that suits them, rather than a single pre-ordained order laid down by the instructor.

The materials should thus be designed on the basis that the order of study is uncertain. No longer should instructors assume that the student has studied Module 4 prior to Module 5, nor that the most complex material has to be placed at the end of the course.

This means that the face-to-face lectures used for so many years are unlikely to form a good basis for effective delivery online. Instead, the materials will almost certainly need to be redesigned not only to make use of the specific strengths (hyperlinks, graphics, animations, etc) provided by the new medium, but also to take advantage of the fact that the Web enables simplified non-sequential access to the course materials.

It is important to note, however, that in the truly flexible environment, there is no longer a need for new course materials and assessment items to have to be delivered every semester. In fact, quite the opposite: materials should be deliberately designed to last for extended periods. Thus, many of the costs and stresses associated with traditional delivery methods may in practice be significantly reduced.

A Revision of the Types of Assessment Used

Difficult as both rationalization and redesign are, both pale into some degree of insignificance when compared to the problem of assessment. In the conventional environment, each assignment item is normally due at some particular date and time, and all students attend examinations simultaneously. If, on the other hand, students can take assessment items at times of their own choosing, what implications does this have?

First, there cannot be direct supervision. This would be both impractical and uneconomic. So some form of assessment must be devised which the student can take unsupervised. This means, in practice, that there cannot be any restriction on the materials to which the student is allowed access.

Second, the assessment must be made available for completion at any time. No longer is it possible to plan based on two or three examination periods per year, for example.

Third, students should not be put at an undue disadvantage because of any failure in technology. Thus, timed online tests, one of the most commonly-used forms of assessment associated with advanced learning technologies, should be avoided wherever possible.

What options does that leave? The most obvious option, the setting of different assessment items for each student in a course, while desirable, is unlikely to be feasible.

However, options do remain. In many conventional courses, take-home examinations are the norm. In others, students are given a list of possible examination questions at the beginning of the course, and informed that the examination will consist of a subset. Both of these point to possible ways forward.

Since students can elect to take assessment items at any time, care must be taken to ensure that solutions to an assessment item made available on Tuesday cannot subsequently be used for an assessment item on Wednesday.

The preferred method of assessment under such circumstances is likely to vary according a number of factors, including the nature of the course itself - for example, whether the content is mainly theoretical or practical, and only guidelines can be given here. Options include: the use of open-book online quizzes, but only where these are untimed, or alternatives are readily available should the technology fail during the taking of a quiz, and questions are randomly selected from a large data-bank; tests which consist of a selection of essay-style questions (which students can choose to submit at any time, of course); and problem-solving tasks where students provide explanations as to their methods of solution.

The use of online electronic submission enables the use of programs specifically designed to check for plagiarism and the copying of unreferenced materials, and it would seem likely that the use of such programs will assume much greater importance in truly flexible delivery.

A Changes to Institutional Timelines

Institutional timelines are generally of three types: timelines imposed by the instructor, normally for pedagogical reasons; timelines imposed by the bureaucracy of the institution, normally for reasons of administrative efficiency; and timelines imposed by outside agencies such as state or federal governments, normally for reasons of accountability and funding.

In the truly flexible model, the first of the three, timelines imposed by the instructor, should be dispensed with entirely. Students should be free to study at their own pace, according to their wishes and the demands of their other commitments, whether they be work-related, social, religious, or whatever.

The second of the three, timelines imposed by the institution, should also be dispensed with. This implies that institutions need to reform their procedures so as to be able to accept enrolments into both programs and course at any time of the year, without the restriction of artificial deadlines. Similarly, successful completion of courses needs to be able to be recorded at any time.

Both administrators and academics will be freed from the limitations of "terms" or "semesters" when students are actively studying, and vacation periods when they are not. Undergraduate students will expect to be able to learn at any time, in much the same way that such a facility is taken for granted by PhD and postgraduate students. One consequence of this is that where possible, each course should be covered by a small team of academics, rather than by a single individual.

The one deadline that institutions may be justified in retaining is the limit to the time a student can spend enrolled in a course without successful completion. Without such a limit, it would be possible for students to remain in a course effectively forever. This is not advantageous to the institution, for two reasons; firstly, the student's presence in the course is likely to be expensive in terms of staff time and resources; and secondly, many courses change over time, and it would be inappropriate for a student to claim successful completion based on mastery of very old material (while one is happy to accept that a student passing Programming 101 in 1972 may well have learnt ALGOL, the same basis would not be acceptable for passing Programming 101 in 2002, for example).

The third of the three timelines, those imposed by outside agencies, are the least easy for the institution to change, for obvious reasons. Nevertheless, it seems at least feasible that the institution seeking to make truly flexible learning a reality would be able to negotiate alternative reporting arrangements. The details of such arrangements would vary from country to country and even state to state, and are clearly beyond the scope of this paper to cover in detail. Nevertheless, the direction is clear: no longer should students be considered to be enrolled in particular courses for particular pre-defined semesters. That is, enrolment number should no longer carry with them implications about specific dates of enrolment, or expected dates of completion.

SUMMARY

This paper has indicated that so-called "flexible learning" is, more often than not, only traditional distance education with printed materials replaced by, or supplemented with, material on the Web, and that the indicated flexibility rarely extends beyond one particular aspect, the geographical location of the learner. True flexibility is achieved only when the use of advanced learning technologies is such as to enable learners to study at times of their own choosing, without the necessity to abide by antiquated procedures and timelines.

Some difficulties of truly flexible learning have been outlined, and some ways forward have been suggested.

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APPLICATION OF A MODEL FOR IMPROVING ICT MANAGEMENT: A CASE STUDY

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ABSTRACT

The rapid diffusion of information and communication technology (ICT) in many organizations, and in public universities in particular, in Kenya during 1980s and '90s, brought with it unprecedented challenges to these organizations. Not only is the technology new to use in many ways and, therefore, requires new skills on the part of users, but for the technical staff it demands from them completely new ways of managing ICT as opposed to those approaches required for managing other types of enterprise resources. The ICT resources continue to increase in numbers, value and sophistication as more and more organizations invest in the new technology, and with it the complexities of managing them become even more pronounced. This development also means that providing ICT services to an increasingly knowledgeable user base, whose requirements for, and expectations from, ICT centers rises continuously, is also becoming a very serious challenge. For the ICT management staff, these requirements represent heavy responsibilities and daunting tasks that demand from them a sound knowledge of ICT management. However, lacking suitable models to apply leads them to adapt different approaches and styles to managing ICT, with serious consequences on the quality of ICT service, which leads to loss of confidence in the new technology by the user community. Recognizing this problem, a model for improving ICT management based on proven models is presented. The results from the case study indicate that the model can be a useful and practical tool to managing ICT effectively and efficiently, not only in public universities, but in other organizations in Kenya and other third world countries.

INTRODUCTION

Increasing amounts of hardware and software have been acquired in the last 10-15 years by an increasing number of organizations, and in particular, the public universities, in Kenya. However, due to lack of research in the management of ICT prior to, during, and after the introduction of ICT in this part of the world, there are signs of growing problems associated with the influx of the new technology. Users have expressed frustration due to unfulfilled expectations of the performance of the new technology. The technical staffs have adopt reactive and often chaotic and *ad hoc* rather than proactive approaches to managing ICT. As argued in (Wanyembi et al. 2000), expectations of users for improved services are not fulfilled due, in part, to low quality of management, control and maintenance of ICT. This leads to poor realization of the potential that can be derived from the investment in the new technology by the universities. The problem cited above can thus be stated briefly as follows.

> There is a lack of complete models for **understanding** and **improving** the **management** of ICT in public universities in Kenya, leading to these institutions failing to realize the full potential of their ICT investments. In addition, there are inherent limitations in many of the existing models, as a result of which these models fail to address situation-specific problems found in many developing countries.

The implication of this statement is that while there are models that have been proven to work elsewhere in the developed world, these models do not take into account the situation-specific factors commonly found in third world countries, which differ, considerably from those of the developed world. The situational factors that characterize much of the third world countries where the infusion of ICT is growing at an unprecedented pace, include age, size, location, level of computer literacy and communication infrastructure. A theoretical framework of these factors together with complexity factors associated with the new technology are presented in this paper, in which we adopt the modelling approach to describe ICT related issues in public universities in Kenya. We also present a 4-function model to improve an ICT situation in an organization from one level to another. A case study where this model was applied is also described and the practical implications of the results of the application are given.

MODELLING ICT RELATED ISSUES IN AN ORGANIZATION

A model can be defined as an abstraction of a concept, object, or event. One model that can be used to describe and manage information and communication technology is the management paradigm. The management paradigm, illustrated in Figure 1 (Looijen 1998), provides a top-level view of concepts of an organization with regard to ICT related issues.

The term paradigm is used to characterize a worldview, a lens through which we are able to identify and focus on key issues (Glazier 1992). Essentially, the management paradigm consists of three basic entities: the *Real System (RS)*, the *Information and Communication Technology (ICT)*, and the *Management, Control, and Maintenance of ICT (MCM)*. Additionally, the *Relationships* between the entities and the *external Influences* that act on the organization constitute vital parts of the paradigm for inclusion due to the role they play.

In modelling issues in a university, we can adopt the systems perspective on organizations and organizational processes. According to this perspective, an organization can be viewed as a system of related objects (Ackoff 71; Checkland 1981; and Sol 1982). In the same organization can also be found people (actors), equipment and materials used (objects) and activities that they perform (processes).

FIGURE 1
THE MANAGEMENT PARADIGM

In the entity Real System (RS) critical issues related to ICT are the user requirements for ICT resources and services, that users demand from their organizations in order to support their day-to-day operational activities and processes. From the point of view of users in their working environments, the most important requirements are the availability of ICT resources and services, the functionality and flexibility of ICT, the maintainability, the performance, the reliability, and the security, of ICT. These requirements are prerequisite to effective performance of users and ultimately their organizations. User requirements exert pressure on the organizations to adopt an integral as opposed to an isolated approach to ICT provision in order to satisfy the demands from students and staff and other interested parties, who are collectively referred to in this paper as users. Thus, in order to realize optimal benefits, the organization should strive towards synergy, transparency and sharing of ICT resources to ensure greatest exploitation, while users strive towards autonomy to control the availability, reliability, and security of their own ICT resources (Wijs 1995) in their respective workplaces.

In the same entity RS, preconditions such as information policy and planning, policies on centralization or decentralization of activities, finances and personnel, dictate to a large extent the manner in which ICT usage can be realized. Additional preconditions include policies on concentration or de-concentration of ICT resources, safety of users and equipment, standardization of hardware/software, and service level agreements (SLA).

Existing situational factors under which technical staff and users operate are critical aspects to consider during the implementation of ICT projects in organizations because situations differ from organization to organization and have been shown to cause risks (Euromethod 1994). The situational (or contingency factors) include the organization's age, size, (Mintzberg 1979), location, technology environment, organizational culture, and general communication infrastructure. These factors must be recognized for the impact they have on organizations and users and accordingly must be taken into account during implementation, utilization and management of ICT. The issues and factors cited above can be effectively modeled in the RS entity of the paradigm.

In the entity ICT, the technology can be modeled to include the components, the states in which it exists, and the complexity factors within which it is utilized, exploited and maintained. The performance of ICT is limited by the characteristics of ICT imposed upon the users. These characteristics include the speed of processors, memory size, and capacities of communication lines. Our perception of ICT is based on the definition of ICT given by (Brussard 1980; Sol 1982, and Looijen 1998), that is, as all the hardware with the relevant basic software and application software, datasets, procedures, and persons, involved in the control or support of the real system or business processes. As Land and Hirschheim emphasize, it is fruitful to think of ICT as not a goal in itself, but as social systems: a complex web of interpersonal relations that produces, utilizes and communicates information (Land 1983). As distinct and separate components, ICT exhibits individual characteristics, which remain practically constant over a period of time. These characteristics are termed static to distinguish them from dynamic characteristics that are associated with implemented ICT. The concept of performance and behavior characteristics of ICT was first introduced by van Hulzen and De Moel (Hulzen et al., 1987), from which a framework of concepts such as availability, continuity, integrity, accessibility, and timeliness was formulated. Then Delen and Rijsenbrij (Delen et al. 1990) made a distinction between static product characteristics and dynamic product characteristics of ICT. Static product characteristics such as processor speed, memory size, are considered relevant to technical and operational staff while dynamic product characteristics such as availability, responsiveness of ICT, are concerns of the user environment.

Extended State Model

Modeled in the entity ICT is the Extended State Model (ESM), which essentially describes the life history cycle of ICT and the states in which ICT may exist at any given point in time. According to Looijen, The *Extended State Model*, see Figure 2, consists of the states information policy and planning (**IPP**), development (**D**), acceptance and implementation (**AI**), utilization (**U1, U2**), exploitation (**E1, E2**) and maintenance (**M1, M2**).

FIGURE 2
THE EXTENDED STATE MODEL

In this paper the states U, E, and M (shaded) are relevant and will be focussed upon as they relate to user requirements more directly than other states. The state utilization (U) involves the users of ICT in their day-to-day activities as they make use of the functions of the information systems. At the organizational level, the state exploitation (E) takes place when the organization takes advantage of ICT to realize its goals. Whenever there are minor problems or modifications to be addressed concerning users and ICT, these are brought to maintenance (M1) while major modifications regarding the extension of ICT for greater exploitation of ICT from the phase E2 are addressed in the state maintenance (M2).

Complexity Factors

Many users and management staff often regard ICT as a complex system. Understanding how it functions under the prevailing circumstances presents itself as a special problem. Most importantly, comprehending how to manage, control and maintain ICT is not always straightforward. Often long periods of training and experience are needed to master some parts of ICT management. This special group of problems is referred to as complexity factors. A total of eight complexity factors associated with ICT management can be identified. These factors relate to the separate ICT components, their interrelations and their usage. The eight complexity factors are number of ICT resources (quantity) which the technical staff are in charge of. The resources can differ in type, make or origin (diversity), and be centralized or de-centralized to a high degree (distribution), and regularly be subjected to changes (dynamics). Other complexity factors are the variety of functions that ICT can have and which need to be mastered by users and technical staff alike (functionality), and which are supplied by a number of linked components (coherence). Finally, in a large university, different owners (ownership) may possess the ICT components and users can have varying requirements and stipulate different preconditions on their usage (usage or utilization).

Forms of ICT Management and ITIL Processes

The entity MCM can be described as entailing the management, control and maintenance of implemented ICT in accordance with the requirements and preconditions imposed by the utilization, the situational factors and characteristics of ICT components. The entity offers ICT management services and positively influences the goals of the organization. Three forms of MCM can be distinguished: the functional management (FM), application management (AP), and technical manage-ment (AM). Their common structure can also be modeled using Mintzberg's logo (Minzberg, 1979). These forms are depicted in Figure 3. We define the three forms of management as follows.

Functional management. This involves managing the functional specifications and the functionality of ICT, i.e., all management tasks that are necessary to support and advise user environments within the framework of the utilization of ICT. The level of ICT utilization determines to a large extent the functionality of ICT.

Application management. This involves the management, control and maintenance of application software and database structures (Wijs 1995, Looijen 1998). Changes can be initiated by faults reported by users, the need to extend the functionality of the software. The latter is referred to as application software maintenance.

Technical management. This involves managing the hardware, the technical infrastructure and the systems software, i.e., all the tasks that are necessary to implement, to accept, and to operate the technical infrastructure. Optimization of the technical infrastructure as a consequence of faults, expansion or replacement is also part of technical management.

Within each of the three forms in the entity MCM are twelve task areas distributed in five basic elements of the organizational structure—the strategic apex, the middle line, the operating core, the techno-structure and the support staff. The task areas are listed in Figure 3 and bear a relationship with *Information Technology Infrastructure Library* (ITIL) processes.

The *Information Technology Infrastructure Library* (ITIL) is identified as a framework of the "*'the best practices and a standard of IT service quality that customers should demand and providers should seek to supply'* (CCTA 1999)." The ITIL provides a total of 9 sets of ICT management processes, popularly known as the best practices'. These sets are: *manager's set, service support, service delivery, software support, networks, computer operations, environmental strategy, environmental management,* and *office environment.* Two of these sets (service support and service delivery) were selected for application in this study in order to focus on the most suitable ICT processes that relate to user requirements for quality ICT services. The two sets

FIGURE 3
FORMS OF MANAGEMENT AND ITIL PROCESSES

Key: Task Areas

SM	Strategic Management
TM	Tactical Management
OM	Operational Management
PM	Personnel Management
GBS	General Business Support
TSu	Technical Support
UM	Utlization Management
FM	Functional Maintenance
AM	Application Maintenance
OC	Operational Control
MTI-OS	Maintenance Technical Infrastuctue and Operational
TSc	Technical Services

are service support and service delivery. Service Support processes include *Change Management(CHG), Configuration Management(CONF), Help Desk (HLP), Problem Management(PRB), and Software Control & Distribution(SCD)* while Service Delivery processes are *Availability Management (AVLM), Capacity Management (CAPM), Contingency Planning (CONT), Cost Management(CSTM), and Service Level Management(SLM).* A typical ICT center that implements the two sets of ITIL processes would look like illustrated in Figure 4, in which, for example,

(a) a **user** makes a call to the *help desk* (first line support) to report an *incident* or malfunction related to hardware/software.

(b) if the *incident* cannot be resolved at this point, the *incident* is referred to the process problem management. The *problem management* process (second line sup-port) investigates the incident to determine the underlying cause. In this process, a request for change (RFC) may be made if necessary, calls in *capacity management* to assist. Henceforth, the *incident* is referred to as a *problem*. *Service level management* is informed that a SLA has been violated.

(c) *change management* process coordinates the request for change (RFC), which runs in parallel with the process *configuration management(see below). Change management process* determines the impacts of the change on both the quality of existing ICT service as well as on the service level agreements. This relates change management to *Service level management process.*

(d) *cost management* process assists, through service level management process, with the business cost justification for hardware/software upgrade with **suppliers**, who then provides new ICT components or services to provide an answer/solution to the problem.

(e) *contingency planning* process becomes involved in change management process either to ensure recovery of services or maintenance of ICT service at acceptable levels as per SLAs.

FIGURE 4
MODELLING PROCESSES AT AN ICT CENTER

(f) *software control and distribution* (SC&D) controls the implementation of the change by rolling out he replacement hardware and software. SC&D also updates *configuration management* with details of new releases and versions.

(g) *availability management* process becomes involved in considering hardware/software upgrade to ensure it meets the required availability and reliability levels.

(h) capacity management, availability management, contingency planning, and cost management processes provide vital data on cost, quality of ICT services, and impacts due to changes, for *configuration management* process. These four processes are also involved in *enactment* of service level agreements between ICT organization and users/suppliers.

(i) *configuration management* process ensures CMDB information is upgraded throughout.

Finally, in the entity MCM, the *capability maturity model* is used to give the levels for improving ICT management processes. The Capability Maturity Model (CMM) developed by Software Engineering Institute (SEI) of Carnegie Mellon University describes the stages or plateaus through which organizations evolve as they define, implement, measure, control, and *improve* their processes (Paulk et al. 1993). However, for this model to be useful in this case, the CMM levels must be redefined in terms of ICT management processes rather than in terms of software processes. The first three of these levels used in this paper are defined as follows:

Level 1 (Initial). At this level there are no management processes and reaction to events happens in an *ad hoc* manner. The management is completely in the hands of operational "authorities" who decide what has to be done. The workload is most of the time high, and the work is carried out in an uncoordinated way. The latter doesn't necessarily mean that all efficiency is ignored. The point is that it cannot be measured, because each separate realization is strongly influenced by the individuals who carry it out.

Level 2 (Repeatable). At this level the work is done in a processes-like manner, but there are no formal process descriptions. The management recognizes the importance of processes like incident management, problem management, change management, configuration management and software control and distribution, and carries them out in a pragmatic way. The decision-making with regards to this is mostly inspired by the fact that similar processes in other organizations or in other situations seemed useful and looked susceptible to repetition, hence the name *repeatable*.

Level 3 (Defined). At this level the management processes are documented and standardized. They are related to the Service Level Agreements (SLA), which are established between the management and the users of the services. This implies that the services of the management are more predictable and that action is taken in a structured way on issues like performance improvement, problem resolution, transport of necessary data and data storage capacity. Due to this, the service users consider the ICT management as a service organization.

Modelling Relationships Between Entities

The importance of modelling relationships between and within entities (See Figure 1) in the management paradigm lies in its ability to reveal the strengths and weaknesses of the various parts of an organization with regard to ICT related issues. These relationships are key to identifying and understanding the problems associated with the management of ICT in an organization.

In summary, the following relationships between the basic entities are defined (the arrow → indicating the relationship defined between entities).

RS→ICT	users in the entity real system impose requirements for resources in the entity ICT to enable them (users) to perform their day-to-day activities. (i.e., RS ***exploits*** ICT).
ICT → RS	information and communication technology resources in the entity ICT support the activities in the entity RS through enhancing effectiveness and efficiency (i.e., ICT ***supports*** RS).
ICT→MCM	information and communication technology resources in the entity ICT provide useful information required for ICT management to the personnel staff in the entity MCM (i.e., ICT ***supports*** MCM).
MCM→ICT	personnel staff in the entity MCM manage the information and communication technology resources in the entity ICT (i.e., MCM uses or ***manages*** ICT).
RS→MCM	the entity RS ***employs*** the entity MCM to manage its information and communication technology resources.
MCM→RS	technical staff in the entity MCM ***responds to requests in*** RS).

The above six relationships play a significant role in effective and efficient management of information and communication technology. Problems related to ICT in organizations can easily be traced to breakdowns in relationships between the relevant entities.

Modelling External Influences

Acting on an organization, such as a university, are the external influences (hereafter simply referred to as influences). Strictly, influences ought to be considered as being part of the real system, but due to their external nature, they are treated in this study as a separate entity. Because the organization receives materials, resources, students, employees, system of laws, finances, and so on from the external environment, and gives back to the same environment trained manpower, feedback information in form of reports, financial returns, research findings, and so on, this entity must necessarily be treated separately from the other entities. Any significant perturbations in the external world is bound to impact on the organization, either positively or negatively, depending on the source, nature and magnitude of the influence. Among the influences identified for inclusion in this study are managerial, donor, technological, economic and cultural influences.

Having thus modeled ICT related issues, by incorporating various models, in the university we present a model to improve the management of ICT in the next section, bearing in mind the role the other issues play in the overall scheme. In this paper we will limit our improvement to the user requirements in the entity RS, and the MCM processes in the entity MCM, against the background of other ICT related issues described in the paradigm.

FUNCTIONS OF ICT IMPROVEMENT MODEL

The ICT management improvement model, is presented in Figure 6, and consists of four functions.

(a) **Depiction** of the IST (German word for current situation)–in the entity RS (*user requirements*),and in the entity MCM *(forms of ICT management, service support and service delivery processes). Based on the criterion existence, these issues are indicated according to whether they exist (in which case a value 1 is given) or not (in which case a value 0 is given).*

(b) **Qualification** of the current situation–issues in the respective entities depicted in (a) are assigned values based on the values 0 = not available, 1 = LOW, 2 = MEDIUM, 3 = HIGH criterion for **effectiveness**. This structured approach is based on the observation that IS (effectiveness) issues are qualitative in nature (Kanungo et al. 1999). In the case of ICT management processes, attributes, X_i, at Levels 2 and 3 are given weighting, W_i, that varies from 1 (for least important) to 3 (for most important issue).

Attributes at Level 2 (and weights, W_i):

If the process is:

on schedule	(1)
cost-effective	(1)
planned	(2)
is practiced	(2)
trained	(2)
enforced	(2)
measured	(2)
process-like	(3)
recognized	(3)
performed pragmatically	(3)
repeat earlier processes	(3)

Attributes at Level 3 (and weights, W_i)

If the process:

has preparedness criteria	(1)
is documented	(1)
is standardized	(2)
is peer reviewed	(2)
has completion criteria	(2)
is related to service criteria	(3)
has predictable services	(3)
has structured actions	(3)
is seen as an organization	(3)

The capability maturity level for a process, L, is obtained by summing up all the values of the attributes calculated from the equation:

$$L = \Sigma(W_i . X_i)/\Sigma(W_i) \qquad (1)$$

It is clear from the equation that a process can take on rational values ranging from 0.0 to 3.0. However, by convention, all processes that have values below 1.0 are automatically assigned a value 1.0. It is also clear that a process can have attributes at all levels, but fail to achieve the highest level if, for example, not all the attributes are not rated HIGH (3). Hence each process is examined across the entire spectrum of attributes, given appropriate values and from these the capability level for that process is calculated. The weights assigned to attributes may be varied according to the person performing the assessment.

(c) **Definition** of the SOLL (German word for future situation)–future situation for each of the issues depicted and qualified in (a) and (b), respectively, is described in terms of what the improved situation should be like. The list of attributes is checked for those attributes that do not score the highest value. For example, if the attribute *practice* at Level 2 scores a value, 1, it implies that there is a need for a higher standard of practice in order to achieve the current level (2). This becomes the desired situtation and in effect defines the SOLL situtation for the attribute fo the preocess in question

(d) **Transformation** is the realization of the new situation from the current (IST) situation.

This function attempts to realize the new situation defined in (c) for each process. Clearly, an appropriate approach is required to transform any situation into a new and better situation than the existing one. Plan of activities must be devised, assignment of responsibilities made, resources such as funds, equipment, staff, and time needed must be acquired, and actual activities performed in order to bring about the new situation. The process takes into

FIGURE 6
ICT MANAGEMENT IMPROVEMENT MODEL

account the prevailing situational and complexity factors, and the external influences, discussed in section on modeling, with the objective of formulating the strategies needed to minimize their impact. Particular attention is paid to the relationships between entities to determine what role, direct or indirect, actors in each entity can play.

THE CASE STUDY:
UNIVERSITY OF NAIROBI, KENYA

The case study chosen for the application of this model, University of Nairobi (www.uonbi.ac.ke), is the oldest and largest of the six public universities in Kenya. Situated in the capital city, the university has a total student population of about 15,000 and comprises seven campuses scattered in and around the city. The campuses were the Main, Choromo, Lower Kabete, Upper Kabete, Kikuyu, Kenyatta National Hospital, and Parklands. This geographical dispersion presents the university with a daunting task in providing its large number of students and staff with the ICT resources and services that they require, especially networking. However, its location also exposes it to the rapid global technological changes compared to other institutions and gives it the advantages of communication and other infrastructures not enjoyed by the other universities.

Three embedded sub-case studies were selected, according to (Yin, 1994), for the application of this model.

- the Joint Admissions Board information system (JABIS)
- the University Library IS (ULIS), which has network of five branches
- the University Network Backbone (UNB)

The Joint Admissions Board has an information system, located in Chiromo campus, that processes the admissions of undergraduates into academic programs in all the six public universities in Kenya. The JKML is the University Library that comprises five branches with the main library being located in the main campus. It has an information system that students use to access Internet and perform searches of remote databases. The University Network backbone located in the Chiromo campus is responsible for developing and managing the university network to enable students and staff to communicate internally and externally. The Institute of Computer Science coordinates all the technical work for the three units.

The method used included presenting the model to the heads of the units concerned and discussing with them in detail each of the issues contained in the model. A schedule for meetings was arranged covering several days during the period August–September 2000. The four-functional model (depiction, qualification, definition and transformation) was covered in detail and each issue qualified jointly by both the researcher and the officials concerned. The results obtained, therefore, represent qualitative descriptions of the situations covered. The results were checked, tabulated, and analyzed, see Tables 1-5.

DEPICTION OF THE *IST* SITUATION

Key: Existence of issue indicated by √ Non-existence of issue indicated by 0

TABLE 1
DEPICTION OF USER REQUIREMENTS

User requirements	Existence of formulation of requirements in sub-case studies		
	JABIS	ULIS	UNB
Availability of ICT	√	√	√
Flexibility of ICT	√	√	√
Maintainability of ICT	√	√	√
Performance of ICT	√	√	√
Reliability of ICT	√	√	√
Safety of people and equipment	√	√	√

TABLE 2
DEPICTION OF MCM PROCESSES

MCM processes	Existence of MCM processes in sub-case studies		
	JABIS	ULIS	UNB
Functional management (FM)	√	√	√
Application management (AM)	√	√	√
Technical management (TM)	√	√	√
Change management (CHG)	0	0	√
Configuration management (CONF)	√	√	√
Help desk (HLP)	√	√	√
Problem management (PRB)	√	√	√
Software control & distribution (SCD)	√	√	√
Availability management (AVLM)	√	√	√
Capacity management (CAPM)	√	√	0
Contingency planning (CONT)	0	0	√
Cost management (CSTM)	√	√	0
Service level management (SLM)	0	0	0

QUALIFICATION OF THE *IST* SITUATION

Low requirement 1 Medium requirement 2 High requirement 3

TABLE 3
QUALIFICATION OF USER REQUIREMENTS

User requirements as an indication of	Level of expression of requirements in sub-case studies		
	JABIS	ULIS	UNB
Availability of ICT	3	3	3
Flexibility of ICT	3	3	3
Maintainability of ICT	3	3	3
Performance of ICT	3	3	3
Reliability of ICT	3	3	3
Safety of people and equipment	3	3	3

Low quality process 1.0 – 1.9 Medium quality process 2.0 – 2.9 High quality process 3.0

TABLE 4
QUALIFICATION OF MCM PROCESSES

MCM processes	Qualification of MCM processes in sub-case studies		
	JABIS	ULIS	UNB
Functional management (FM)	1.0	1.1	1.1
Application management (AM)	1.4	1.0	1.0
Technical management (TM)	1.0	1.0	1.0
Change management (CHG)	1.0	1.0	1.0
Configuration management (CONF)	1.0	1.1	1.1
Help desk (HLP)	1.2	1.0	1.0
Problem management (PRB)	1.0	1.0	1.0
Software control & distribution (SCD)	1.0	1.5	1.5
Availability management (AVLM)	1.0	1.0	1.1
Capacity management (CAPM)	1.0	1.0	1.0
Contingency planning (CONT)	1.0	1.0	1.0
Cost management (CSTM)	1.0	1.3	1.3
Service level management (SLM)	1.0	1.0	1.0

The values for each sub-case study were obtained and compared. They showed that in almost all sub-cases, the standard of ICT management processes were very low (Level 1).

For the sub-case study JABIS, 4 processes (TM, CHG, CONT, SLM) out of 13 representing (31%) of the processes were not performed at all. Of the remaining 9 processes, 81.8% of their attributes were rated at LOW (1), while 18.2% of the attributes were rated at •MEDIUM (2). No attribute was rated HIGH (3).

In the sub-case ULIS, a similar picture emerged with 2 processes, (CONT, SLM), representing 15.4%, not being performed at all. Of the remaining 11 processes (84.6%), 74.8% had their attributes rated at LOW (1), 22.1% at MEDIUM (2), and only 3.1% rated at HIGH (3).

In the sub-case study UNB, 2 processes (CONT, SLM) out of 13 processes representing 15.4%, were not performed at all. Of the remaining 11 processes (84.6%), had 74.4% of their attributes rated at LOW (1), 23.8% rated at MEDIUM (2), and only 1.8% rated at HIGH (3). The overall capability levels are given in Table. By convention all non-existent processes and those that fall below level 1.0 are regarded as being at Level 1.

DEFINITION OF THE *SOLL* SITUATION

User Requirements

Since the level of requirements was high among users, and it was desirable that it remained high, the future situation was defined as the same level as the current one. That is the user awareness should always remain high.

The SOLL situation for ICT management processes, indicated in *brackets*, are shown in Table 5.

In the sub-cases JABIS, ULIS, and UNB, the processes that were not performed (TM, CHG, CONT, SLM), needed to be recognized, adopted and implemented as a priority due to the importance of the processes. This level of these processes should be at Level 2 at least. With those processes that were being performed at LOW (1) level, the future situation should be enhanced performance through careful planning, practice, training, enforcement, measuring, and performing activities in a process-like manner. Additional ways include giving the processes more due recognition by authorities as well as learning from earlier successes. At a higher level, there was need, before performing any process, to have a

TABLE 5
DEFINITION OF SOLL SITUATION FOR MCM PROCESSES

MCM processes	**Definition of SOLL situation for MCM processes in sub-case studies**		
	JABIS	**ULIS**	**UNB**
Functional management (FM)	1.0 *(2.0)*	1.1 *(2.0)*	1.1 *(2.0)*
Application management (AM)	1.4 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Technical management (TM)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Change management (CHG)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Configuration management (CONF)	1.0 *(2.0)*	1.1 *(2.0)*	1.1 *(2.0)*
Help desk (HLP)	1.2 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Problem management (PRB)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Software control & distribution (SCD)	1.0 *(2.0)*	1.5 *(2.0)*	1.5 *(2.0)*
Availability management (AVLM)	1.0 *(2.0)*	1.0 *(2.0)*	1.1 *(2.0)*
Capacity management (CAPM)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Contingency planning (CONT)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*
Cost management (CSTM)	1.0 *(2.0)*	1.3 *(2.0)*	1.3 *(2.0)*
Service level management (SLM)	1.0 *(2.0)*	1.0 *(2.0)*	1.0 *(2.0)*

preparedness criteria, document the processes, standardizing the processes, and peer reviewing the processes. Additionally, there should always be a completion criteria whenever a process is completed. All these activities should be aimed at capability level 2 in order to bridge the gap that exists between the level of user requirements (3) and the current level at which the processes are being performed.

TRANSFORMATION FROM *IST* TO *SOLL* SITUATION

From the table of qualification it become clear that most processes were rated at Level 1 mainly because most of these processes were not established, or were being performed at LOW level. A process to transform the current situation to the future situation as defined above, was proposed. It consisted of three important steps.

- selecting the issue to be transformed
- considering the future situation in relation to the current situation
- defining the criterion for achieving the goal
- determining the resources needed to transform the situation
- planning the transformation activities
- acquisition of the resources needed
- carrying out the activities required
- comparing the results with the criterion set

The results of transformation were in most cases inconclusive for the simple reason that the time needed to carry out the transformation activities was short. Of greater importance, however, were the resources needed to transform a situation, including funds for training and equipment. Only in a few cases was it possible to achieve any tangible results. The authorities, however, recognized the value of the model and adopted it for use in their respective sub-cases.

SUMMARY AND CONCLUSION

The model presented in this case study can be summarized as follows.

(a) The model created awareness of vital ICT management and related issues and served a medium of communication among the stakeholders, thus facilitating cooperation among them, which had been lacking.

(b) The model enabled the officials concerned and the researcher to identify the ICT management processes that were either non-existent, or, if they were, describe and qualify them as per the model. The future situations were and even define key issues related to ICT management in the university that they required.

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(c) Using the adapted CMM framework, it become clear that, despite being aware of ICT management processes, the management of ICT in public universities is still at the Initial level (Level 1). Also there was a wide discrepancy/gap between what the users require (HIGH 3) and what the ICT services are provided (LOW 1) by a factor of three (3) on the average. The challenge is to bridge the gap by improving the ICT management.

(d) The units generally lacked the resources (funds, training opportunities, materials, equipment) necessary to improve their ICT management processes from their current situations.

The model presented in this paper is a combination of established models adapted for application in the Kenyan public university context. Its primary purpose IS to create awareness and establish a basis for communication among stakeholders (management, technical staff and users) on matters concerning ICT management. Its application is an attempt to come to terms with a growing problem of management of ICT in an increasingly complex situation brought about by the rapid influx of information technology into a world that was largely unprepared. It can be concluded that the model presents a practical solution to the emerging challenges of the new technology in Kenya and much of the third world countries.

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ROBOCUP: MULTI-DISCIPLINARY SENIOR DESIGN PROJECT

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ABSTRACT

A cross-college team of educators has developed a collaborative, multi-disciplinary senior design course at the University. This course offers an attractive opportunity for students from a variety of disciplines to work together in a learning community to accomplish a challenging task. It provides a novel multi-disciplinary learning environment where they will be encouraged to think about issues related not only to their own major, but more global issues that are extremely relevant to real-world design situations. The project has the potential to enhance and extend the reputation of the University as a leader in equipping Mechanical and Electrical Engineers, Computer Scientists, and Business students for the fast-paced, dynamic, team-oriented careers that are becoming the norm in industry. The proposed project for this activity is designing, constructing, programming, and controlling a team of robots for the international RoboCup competition. This event, featuring mobile robots competing in the game of soccer, promises to provide the University high-visibility, positive exposure to help recruit quality undergraduate students. The College of Engineering & Technology is currently seeking industrial sponsorship for the proposed RoboCup team. Project results will be used in a proposal to the NSF Education Directorate.

OBJECTIVE

When students graduate from the University they are equipped with skills relevant to a particular discipline. However, their education rarely prepares them for the situation that many encounter in the workplace: participation in multi-disciplinary teams. To enhance the undergraduate educational experience, the faculty involved propose to develop a multi-disciplinary senior design course within the College of Engineering & Technology and the College of Business.

The proposed multi-disciplinary senior design course involves curricular innovation, building a new multi-disciplinary learning community. Although an initial goal of the course is to enhance and extend senior design courses, the project focus will enable faculty to also transfer the collective research results into undergraduate education and to involve undergraduate students in research activities. The faculty involved intend to leverage the existing funding and demonstrated institutional commitment by submitting an NSF Education Proposal. Finally, the proposed project, RoboCup (mobile robots competing in the game of soccer), will bring positive recognition to the University via the team of students competing in this highly publicized, international competition. This will enhance the ability to recruit quality students to the University.

BACKGROUND

Professors from the School of Electrical Engineering and Computer Science, the Department of Mechanical Engineering and the Department of Management Information Systems have held meetings to consider the problem of educating students for success in multi-disciplinary team environments. The results of the discussions are (1) an analysis of the problem, (2) the means by which the faculty involved should test whether a proposed solution solves the problem and (3) a proposed solution. The remainder of this paper presents the results of the discussions and the plan to implement the solution.

The problem of educating students for success in multi-disciplinary team environments is one that needs to be addressed. Professional engineers are often confronted with the challenges of constructing, modifying and maintaining very large and complex systems, such as aircraft, spacecraft, ships and automated factories. Without exposure to the broad range of skills required by such challenges, engineers will not know how to approach them in the most effective way. For example, an electrical engineer tasked with developing an autonomous mobile robot for an automated factory may attempt to design and construct the entire robot herself. Such an approach is not likely to be as successful as one in which a mechanical engineer is involved with the motor, drive train and platform aspects and a software engineer contributes the algorithmic designs.

The current curriculum within the College of Engineering & Technology does not prepare students as well as it could for multi-disciplinary environments. Rather, depth and breadth are provided within a single discipline. For example, a software engineer learns:

- How to program a computer in several programming languages;
- Concepts for developing a broad range of specific software systems such as databases, operating systems, network protocols, compilers and intelligent reasoning systems;
- Methods for analyzing the complexity of software; and
- Techniques for software requirements analysis, design and testing.

A similar approach is taken within the other engineering disciplines. Such an approach does not provide exposure to the challenges inherent in a complex system requiring knowledge of multiple disciplines. Therefore, it does not allow the students an opportunity to learn the skills needed for success in such a project. Furthermore, it can give students the false notion that they can ignore certain aspects of a complex system. For example, a software engineer who is unaware of a software performance constraint that is derived from the physics of a system may develop software that simply ignores such a constraint, leading to eventual malfunctioning of the system. The faculty involved propose to address this serious problem.

How can one evaluate whether the proposed solution solves the problem? First, it must be determined whether the solution does indeed address the problem. A good solution will address the problem if and only if it offers the students an opportunity to develop the skills necessary for functioning in multi-disciplinary teams for the purpose of engineering complex systems. Second, one should consider whether the proposed solution could be implemented without causing other problems. It should not increase the length of time required to complete an engineering degree, and the depth and breadth provided by current engineering programs should not be compromised. The required course sequences should change very little. Finally, the issues of coordinating and assessing multi-disciplinary teams of students should be addressed.

POTENTIAL SOLUTIONS

When considering possible solutions to the problem, two candidates were identified. One possibility is to teach students about the skills developed in each discipline. While it is probable that this solution could be implemented without causing other problems, it would not provide the students with an opportunity to work with individuals in other disciplines; consequently, the depth of learning would not be very great. A second possibility is to have teams of students from various disciplines cooperate in an engineering endeavor. This would address the problem, since it would allow students from diverse disciplines to learn how to cooperate synergistically. Would it create additional problems?

Currently, Mechanical Engineering and Electrical Engineering curricula include a "Capstone Senior Design" course in which the students apply their skills to a complex problem in their discipline. Similarly, Computer Science students take a "Software Engineering" course in their final year. The faculty involved propose to have students in these courses work on multi-disciplinary team projects; this approach would avert all of the aforementioned problems, except for the coordination and assessment of multi-disciplinary teams. To address the issue of coordination within a multi-disciplinary team, the faculty involved propose to include students from the College of Business in each team. This will allow the business students to practice skills such as schedule planning and milestone tracking, communication, integration and testing, risk mitigation. *It would also allow the engineering students to focus on* the engineering challenges and to benefit from the management skills of others. It is also proposed to utilize one TA from each engineering discipline. The responsibilities of each TA will include assistance with laboratory work, assessment of work and assistance with the multi-disciplinary curriculum development.

PRODUCTS

Since a multi-disciplinary team project addresses the problem and can be implemented in a manner that does not create additional problems, the faculty involved propose to conduct a pilot project during the 2000-2001 academic year. The specific products that the faculty involved will develop include:

- Course materials for a multi-disciplinary senior design course;
- A set of potential projects for such a course for future years;
- A reusable, extensible platform for multi-disciplinary senior design projects;
- Procedures and policies for multi-disciplinary team communication and coordination;
- A proposal to the National Science Foundation Education Directorate; and
- A scholarly publication for submission to an educational conference and/or journal.

ROBOCUP PROJECT

One question that needs an answer is "What would make a good Multi-disciplinary Project?" The problem of building a team of cooperating mobile robots is a good one. It involves mechanical, electrical and software design. It is sufficiently complex to present a challenge to students, but is feasible for them to complete in the three-quarter time allocated for a Senior Design course. Although an initial investment in hardware is requested from internal funds (more than equally matched by departmental funds), the result would be a *reusable* platform; thus, the cost in subsequent years would decrease because the senior design projects could involve incremental refinement of the robotic platform. Another reason for choosing this particular project is that there is an international competition that students can enter with their team of robots. The competition is RoboCup—a tournament in which teams of mobile robots compete in the game of soccer. The common goal of competing in the RoboCup event would help to promote cohesiveness and commitment within the multi-disciplinary team. Thus, the faculty involved request funds for representatives of the team to travel to the competition. Competing in the RoboCup event would be a valuable educational experience for the students. Another benefit of having the students compete is that it would increase the visibility of the University. RoboCup has been featured on the Discover Channel's Scientific America Frontiers program.

MULTI-DISCIPLINARY WORK EFFORTS

The cooperating mobile robots project offers many challenging aspects for Mechanical Engineers, Electrical Engineers, Software Engineers and Managers. The ME students will be responsible for design and integration of mechanical hardware and low-level control. The specific tasks are:

- Defining the specification of dynamic performance;
- Selecting/sizing the drive-train of the robotesigning/fabricating/assembling the mechanical parts of the robot;
- Designing/fabricating/assembling a kicking mechanism;
- Designing/implementation/testing low-level servo control (software/hardware) with EE students;
- Development of on-line dynamic path planning;
- Documenting/communicating with EE, CS, MIS to integrate the overall system; and
- Testing/evaluating of the overall system with EE, CS, MIS.

The Electrical Engineers will contribute to the team in the following areas.

- Design and implementation of the robot's on-board computing hardware
- Design and implementation of the robot's on-board system software

- Design and implementation of the wireless communication system
- Selection and integration of the robot's on-board sensors
- Design and implementation of the motor drive and control system with ME students
- Overall system integration with ME, CS, and MIS students
- Evaluation and test of the overall system with CS, MIS students, and ME

The Software Engineers will focus on the following aspects of the problem.

- Design, development and testing of all software
- Vision and sensing processing
- Artificial Intelligence (Planning, Strategy analysis, and Learning)
- Distributed Systems
- Real-Time Computing

The MIS/Business students will apply the following skills.

- Resource Management
- Time Management
- Risk Assessment & Risk Control
- Unit & System Testing Design
- Teamwork & Leadership
- Quality Assurance
- Software Inspection & Walkthroughs
- System Planning, Analysis & Design

IMPACT AND EVALUATION

The initial project impact will be small in terms of number of students benefiting because the faculty involved plan a small pilot intentionally. However, assuming project success, this innovative multi-disciplinary approach to senior design courses could impact every senior in the respective disciplines (approximately 180 students graduated per year) in the future. The project focuses on three-quarter efforts, rather than just one quarter. Also, this project can serve as a model for the College of Engineering & Technology and potentially many areas within the University that can benefit from a multi-disciplinary senior capstone course approach. The project impact will be significant in improving the planned NSF Education proposal with concrete experience and demonstrated the University investment. The project will also bring name recognition to the University through the RoboCup competition.

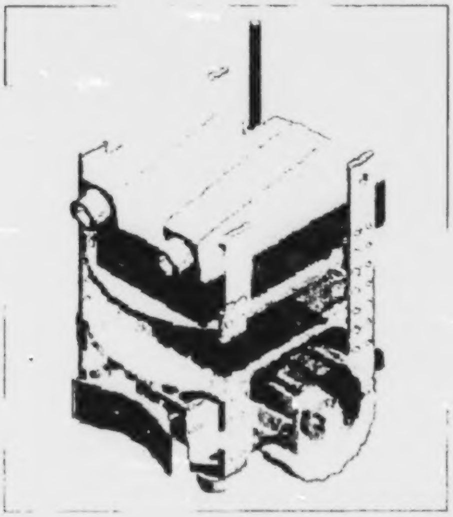
The one-year pilot project will be evaluated by comparing the multi-disciplinary student teams' results against those of senior students who go through the traditional single-discipline three-quarter senior design sequence. This will be challenging in that the hardware projects will be different; however, the quality, robustness, and depth of products can be compared between the single- and multi-disciplinary approaches. The faculty involved believe that the multi-disciplinary approach is significantly stronger; however, another important evaluation criterion is logistics: did the pilot project succeed in terms of large teams, different departmental administration, and different backgrounds? Part of the result will be a plan for improved multi-disciplinary teamwork in undergraduate education.

SUMMARY OF WORK TO DATE

The proposed RoboCup team has been holding collaborative, multi-disciplinary design meetings during Winter and Spring quarters, 2000. The faculty involved are primarily talking about the proposed multi-disciplinary senior design curriculum, but the faculty involved are also currently involving undergraduate students in preliminary mobile robot designs, sponsored by the NSF Research Experiences for Undergraduates

(REU) program. The figure below shows a CAD model of an early conceptual design for a mobile soccer-playing robot.

FIGURE 1
EARLY CONCEPTUAL DESIGN
FOR ROBOCUP MOBILE ROBOT



During Winter 2000 Dr. Peter Stone addressed the team regarding RoboCup via the Stocker Visiting Lecturer program. Dr. Stone, employed by AT&T, recently graduated from Carnegie-Mellon University (CMU), where he has competed successfully in RoboCup since its inception in 1997.

Two teams of Electrical Engineering undergraduates competed in an IEEE competition for mobile robots collecting steel and brass balls autonomously. Though this project had little input from Computer Science and Mechanical Engineering, the problem is related to mobile robots playing soccer, so the University has started building experience in this area.

Currently Mechanical Engineering is teaching ME 455, Mechatronics. The class project is to convert a mobile toy car from joystick control to autonomous on-board-computer-based control. This project is closely related to the RoboCup needs, spanning the software, electronics, and mechanical disciplines. This can be done better with involvement from the three areas rather than just one.

During the Fall and Winter 2000 and 2001 the students have enrolled in the various senior projects courses and have built prototype robot components. During the Spring 2001 the students implemented the prototypes and during the summer 2001 the competition was held. Results will be presented at various conferences in the Fall 2001. Multiple papers on various theoretical and teaching aspects of this project have been accepted and presented at several conferences in various disciplines.

VARIOUS BUDGET DATA

The graduate teaching assistants (TA) are crucial for project success, working with the PIs, undergraduate students, and technicians both on multi-disciplinary curriculum development and on practical robot hardware design, construction, programming, and control. The total requested budget is $24,000, for two teaching assistants working for four quarters at $3,000 per quarter. The Internal Education Fund is requested to provide half this amount and the departments will provide matching for an equal amount. The College of Engineering & Technology will also provide tuition scholarships for these eight quarters of work.

The hardware budget is intended to purchase required components for building the team of RoboCup robots. These components include motors, motor drive circuitry, PC boards, wireless communication equipment, sensors, and video cameras with frame grabbers, wheels, and gear transmissions. The early designs indicate a cost of approximately $3,500 per robot for six robots, plus a one-time cost of $1,000 for communication hardware, which is used for all six robots, for a total of $22,000 in hardware components. The Internal Education Fund is requested to provide $12,000 for hardware, to be partially matched with $1,000 from the College of Engineering & Technology, $1,000 from the Pace Grants Consortium, $6,000 from the Electrical Engineering and Computer Science department, and $2,000 from the Mechanical Engineering department.

A total of $500 is requested from the Internal Education Fund to provide required supplies for supporting robot construction. Though not shown formally as matching, the College of Engineering & Technology and departments will contribute to supplies via existing stock and purchases.

The travel budget is intended to partially support: 1) sending a portion of the RoboCup team (PIs, undergraduate students, and TAs) to Seattle during the summer of 2001 to represent the University for the first time at the international, high-profile RoboCup competition; and 2) presenting project results (multi-disciplinary senior design projects) at an educational conference. The Internal Education Fund is requested to provide $5,000 for travel, to be matched equally by the College of Engineering & Technology ($3,000), and the departments ($2,000).

Finally, technician labor is required to assist students, TAs, and the PIs in producing polished, professional robots worthy of representing the University, built for reliability. The College of Engineering & Technology will provide the sole support, $1,000 for each of two technicians (machinist and hardware/software technicians). This will provide a total of 100 technician hours at $20 per hour.

CONCLUSION

This course/project offers the opportunity for a variety of disciplines to work together in a learning community to accomplish a challenging task. It provides a multi-disciplinary learning environment that does not exist on very many campuses. It encourages students to think about issues related not only to their own major, but more global issues that are extremely relevant to real world design situations. The project has the potential to enhance and extend the reputation of the University as a leader in equipping Mechanical and Electrical Engineers, Computer Scientists, and Business students for the fast-paced, dynamic, team-oriented careers that are becoming the norm in industry. The proposed project for this activity, the international RoboCup competition, promises to provide the University high-visibility, positive exposure to help recruit quality undergraduate students. This model could be adopted by any university with engineering, computer science and information systems departments.

CULTURAL AND GENDER ISSUES IN THE COMPUTER AND INFORMATION TECHNOLOGY CURRICULUM

Panel

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The members of the panel participated in a working group at the 4th Annual SIGCSE/SIGCUE ITiCSE (Integrating Technology into Computer Science Education) addressing this issue in a final paper that will be published in *ACM SIGCSE* 2001. They also contributed to previous working groups concentrating on professionalism and ethical issues in the Computer and Information Technology Curriculum.

ABSTRACT

Industry leaders and educators in Computer and Information Technology (CIT) have expressed a need for graduates to have a background in professional, societal, and ethical concerns as well as a strong technical capability (Huff and Martin, 1995). Some educators have gone so far as to include cultural awareness: "The cultural dimensions of information technology can no longer be ignored, with the expansion of the global economy, global markets and global communication enabled by information technology" (Hasan and Ditsa, 1998, p. 5). The rationale for supporting and enhancing instruction in cultural issues for CIT workers comes from the growing globalization of the world in communication, the increase of trans-national organizational mergers and partnerships, the merging of various populations within national boundaries, the increasing traffic of individuals to different countries around the world, and the severe shortage of information technology personnel throughout the world. This panel will provide material to support the inclusion of cultural issues within the CIT curriculum. The topics identified, which include diversity and multiculturalism, organizational cultures, professional cultures, socio-economic issues, and gender issues, form a foundation body of knowledge that, once learned, can improve and enhance the work of the information technology professional. Some exercises are provided that can be incorporated into existing CIT courses across a wide variety of programs, nations, and cultures. As the internationalization of education continues, more exercises and examples will surely arise from the CIT community.

PANEL PROPOSAL

Hofstede (1991, p. 5) defines culture as "the collective programming of the mind which distinguishes the members of one group or category of people from another. "More simply, culture is shared values of a particular group of people (Erez & Early, 1993) and culture reflects the core values and beliefs of individuals, which are formed during childhood and reinforced throughout life (Shore & Vankatachalam, 1996). This implies that culture is all pervasive and has a strong influence on all our undertakings (Hasan & Ditsa, 1997, p. 6). How we view and design computer systems is also defined by our culture, despite the tendency of Western scientists to see themselves as being objective and transcultural (Harding, 1998).

Students in today's university programs will be the CIT professionals of tomorrow. Industry and workplace professionals realize that skills beyond the technical are vital to the success of the student. Instructors have a responsibility to the students of today to prepare them for the world of tomorrow in both the technical arena and in the cultural one. In many settings, instructors are not prepared to teach such topics as these without substantial assistance. Tutorials and workshops are needed to bring teachers together to discuss cultural matters, to allow them to learn how they are important to the workplace, and to help them learn how to teach them.

Cultural issues are becoming more important as the world moves toward increased communication and globalization. Many corporate mergers occur across national boundaries, requiring personnel to be more aware of national and ethnic differences. Also, those students from more economically successful countries have better access to the technology, and, in addition, have more opportunity to attend classes and gain knowledge. Recent reports from around the world conclude that this economic gap has caused a "digital divide that will continue to worsen without government support and intervention (Smythe, 2000; Independent Television Service, 2000). The shortage of information technology workers in the United States is well documented (Freeman and Aspray, 1999; Anderson, 1997). The organizational world has addressed the shortage by delaying retirement, increasing productivity expectations and encouraging governments to liberalize immigrations policies (CPST, 2000). Another emerging trend among corporate giants is "outsourcing of information technology work, as many companies move work to other countries where personnel are available, often at less cost (Van den Berg and Mantelaers, 1999).

The occupational demographics in the United States show that most information technology personnel are male Caucasians, with the representation of ethnic minority workers very low. A similar disproportionality is evident in Australia and New Zealand with indigenous and Pacific Island peoples underrepresented. Additionally, in many countries there are drastically fewer women in the CIT workforce than men (Harrelson, 1998; Camp, 1997). A great many support groups for women in IT have arisen in the United States to study and promote the proportion of women in computing. Even though much progress has been made by these efforts, there is still much more to be accomplished (Dwight, 2000). The shortage of information technology workers overall is exacerbated by the lack of appropriate numbers from minority ethnic group populations and the lack of appropriate numbers of women (Bajcsy and Reynolds, 2000).

Studies of graduates in the United States reveal what is now called the "pipeline effect, which refers to the decreasing numbers of women completing CIT programs in universities (Camp, 1997). Graduates in information technology related programs, whether computer science or other types, include small numbers of women and minorities. The same trend is visible in many other industrialized countries (Ølnes, 1999; Vosseberg, 1999; Selby et al, 1998). Causes of the under-representation of women students in CIT include "the structural conditions of the teaching environments, a lack of women lecturers, lack of knowledge about career prospects among girls, as well as the image of computer science and information technology and computing as a male domain, and a perceived lack of confidence amongst women students despite their obvious abilities and successes. (Salminen-Karlsson, 1999; Selby et al, 1998).

Some of the cultural areas to be addressed in the panel are:

Multiculturalism refers to the diversity of our world population, differences of persons from multiple ethnic groups and multiple national origins, and the ongoing tendency toward globalization of our world society;

Organizational cultures refers to differences in various organizations and how they function, as well as differences between public government and non-profit organizations and private industry. Policies established for the organization, such as privacy, equal opportunity, immigration for workforce enhancement, electronic mail, copyright and patent law policies, etc., are to be included in this category;

Professional cultures refers to the broad field of computing and information technology as an industry. This category includes topics such as workforce supply/demand studies, personnel research, acceptable professional standards and practices, codes of ethics, personality profiles of the workforce, characteristics of workers, acceptable educational practices, certification and licensing requirements, and need for continued updating and training of professional workers;

Socio-economic issues refers to equal opportunity to education, equity of access to technology usage, and the growing concern that technology is further dividing the have's from the have-not's; and

Gender issues refers to differences between men and women in behavior and in their role in the information technology field. It can also refer to actions related to the treatment of, and the behavior toward, persons of different gender.

Many organizations in the computer and information technology arena are moving toward increased globalization and increased work in multinational settings. With the worldwide shortage of computer and information technology personnel and the worldwide development of computer systems for multinational audiences using multicultural personnel, there is an even stronger need for understanding cultural differences.

This panel is meant to raise awareness among the academic community that cultural issues are important issues in the CIT curricula. It also provides exercises that can be incorporated into courses within a variety of CIT programs and courses.

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EFFECTIVE CASE STUDY METHODOLOGIES IN THE MANAGEMENT OF IT COURSES

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ABSTRACT

Many AACSB accredited schools require undergraduates MIS majors to take a course in the management of information technology. Over half of these schools utilize case studies in the teaching of this course. We believe that case studies are an important vehicle for teaching crucial IT management issues, particularly in providing students with a real-world example of organizational issues. We believe that case studies are best taught in an active, collaborative environment. Based upon our understanding of collaborative learning and collaborative teaching, we propose a procedure for enhancing the effectiveness of this active learning methodology.

COLLABORATIVE LEARNING

Collaborative learning is defined as a learning process emphasizing group or cooperative efforts among faculty and students, stressing active participation and interaction on the part of both students and instructors (Brufee, 1984). Collaborative learning has long been stressed as an effective teaching methodology by theorists (Vygotsky, 1978). A review of the literature of peer/collaborative learning can be found in McKeachie (1999).

The importance of collaborative learning extends to the business environment, particularly in the use of teams to accomplish business tasks. The effectiveness of using teams to accomplish information systems tasks in the business environment is well recognized (El-Shinnawy and Vinze, 1998; Janz, 1999). Surveys of employers indicate that teamwork skills are among the most important when evaluating IS graduates for entry-level positions. Employers have rated teamwork skills as more important than systems analysis and design, database, or programming skills (Van Slyke, Kittner and Cheney, 1998).

Collaborative learning is recognized as an effective teaching methodology in MIS programs in the United States. Through collaborative learning, students learn to take advantage of each team member's expertise and to experience first-hand the problems of coordinating a team effort (Goyal, 1995/1996). Studies have shown that collaborative learning leads to a higher degree of satisfaction with the learning process, to a greater motivation to learn, and to better performance (Flynn, 1992).

Aram and Noble (1999) argue that the traditional lecture approach does not adequately prepare students to understand and cope with the levels of ambiguity and uncertainty they will inevitably face when assuming entry level positions. Collaborative learning can be utilized in a number of class settings, and it is particularly appropriate for system development projects. Collaborative learning can also be effectively used for research projects and simulations. However, it is our intention to focus on how teachers can utilize techniques of collaborative learning in the teaching of case studies in the Management of IT course.

COLLABORATIVE TEACHING

Instructors in a collaborative teaching environment can also realize some of the same advantages enjoyed in a collaborative learning environment. In particular, instructors can benefit from synergistic effects promoted by team dynamics. In addition, collaborative teaching can lead to a quicker development of best teaching practices.

Brabston, et al. (1999) proposed three models for collaborative team teaching.

1. The interactive model. Two or more instructors in front of the class at any one time.
2. The rotational model. Each member of the teaching team teaches in only that part of the course related to his or her area of expertise.
3. The participant-observer model. Each team member alternately takes the lead in teaching. The other team member primarily observes but also actively participates when appropriate.

We will later present a fourth model for collaborative team teaching.

CASE STUDIES

Case studies are an important tool for teaching MIS concepts. Romm and Pliskin (2000) cite a study by Lee, Trauth and Farwell (1995) showing four major clusters of knowledge/skills required of MIS personnel in the upcoming decades.

1. Technical Specialties Knowledge/Skills: including operating systems, programming languages, database management systems, networks, telecommunications, etc.
2. Technology Management Knowledge/Skills: including issues such as where and how to deploy information technologies effectively for meeting strategic business objectives.
3. Business Functional Knowledge/Skills: including how to re-engineer business processes before the adoption of a new information system to produce maximum benefit from the system.
4. Interpersonal and Management Knowledge/Skills: which relate to the "boundary-spanning role of IS personnel. This role requires IS professionals to master interpersonal skills such as selling, negotiating, leading, and counseling.

Romm and Pliskin (2000) note that of these four skills, three of them technology management, business knowledge, and interpersonal skills are not the traditional "hard skills associated with an IS education, but rather can be classified as "soft skills because they emphasize an understanding and ability to work with people rather than machines. Romm and Wong (1997) persuasively argue that the best way of teaching these soft skills is through the use of case studies.

Case studies are routinely used in a number of MIS courses. In a content analysis of 34 electronic commerce course syllabi, Sendall (1999) found that 44 percent of e-commerce classes were incorporating case studies as part of the curriculum.

Our focus is on the IT management course at the undergraduate level. We believe that this course is critically important to the MIS major, and we share the surprise of O'Hara and Stephens (1999), who found that this course is not universally required at AACSB-accredited schools. In their study, O'Hara and Stephens content analyzed 39 undergraduate syllabi of the IT management course. They found that the most common assessment method of students in this course were exams, quizzes, case study analyses, research papers or topic studies, computer-based projects, reports, and assignments. Of the 39 courses, only 51 percent utilized case studies. Further, case analyses accounted for only 16 percent of the grade, on average.

TEACHING CASE STUDIES THROUGH COLLABORATIVE LEARNING

Case studies can be taught with many different methodologies. Romm and Mahler (1991) describe five methodologies.

1. Individual processing. Students prepare for cases as individuals.
2. Chronological group discussion. Each case is presented via a team (and instructor) with the team intact throughout the interactive discussion.

3. Simultaneous group discussion. Each case is first discussed in sub-units, which later recombine as one large group.

4. Chronological group dramatization. Cases are dramatized with the all students serving either as actors or audience.

5. Simultaneous group dramatization. Students first break into sub-units which later recombine for case dramatization.

Each of these methodologies has its virtues, and each involves a certain amount of active learning. Annette Jones (2000) summarizes the argument for active learning.

> Active learning is based on the assumption that learning is by nature an active undertaking, and that different people learn in different ways (Meyers & Jones, 1993); it presumes that students learn best by doing. Active learning provides opportunities for students to talk and listen, read, write and reflect on course content through problem-solving exercises, small group discussions, simulations, case studies and other activities. Biggs (1999) also suggests that active engagement in the learning process encourages the less academic student to employ high-level engagement techniques such as theorization, reflection, application, which are more naturally adopted by the more academic student even if the teaching method is more passive.

We believe that one of the greatest strengths of teaching cases is the flexibility which they provide the instructor. A teaching case allows an instructor to choose the level of depth for discussion of a topic, as well as which topics, theories, and practices are discussed. While many teachers have developed their own pedagogical methods for teaching cases, there is no generally accepted prescription for one "right way to teach cases.

As we continue to sharpen our teaching skills, several questions occur to those of us that teach cases in class. These questions generally center on inquiry as to whether our approach is the most appropriate. Generally, the purpose of case instruction is to provide a real-world example of the issues that organizations must face. Such exposure allows students the opportunity to identify issues and problems faced by a firm, to see vague, conflicting and often ill-structured business scenarios, to evaluate decisions made by the principles, to relate theory and concepts to a specific instance, and/or to make recommendations about what should be done based upon the student's own knowledge of the subject matter. As such, it is always our hope that the material will "come alive for the students, generating high interest because of the fact that the issues are real and the companies are struggling to deal with them.

Most teachers who have been teaching cases for a while have developed his or her own particular method for conducting discussion of a case in class. We next sketch out the two methodologies we have most recently followed.

CASE STUDIES IN THE IT MANAGEMENT COURSE AT OUR UNIVERSITY

Each of the two authors of this study teach the IT Management course. For the past three years, one of us teaches the course in the fall semester, and the other in the spring. Both of us are proponents of active, collaborative learning in the teaching of cases. Both of us are interested in improving the effectiveness of our teaching. We have in the past informally discussed the teaching of cases in our respective classes, and have determined that a more formal approach to improving our teaching is in order.

As a result of our informal discussions we have developed a case study evaluation instrument. It was administered for the first time in Spring 2001, and our intention is to administer the same instrument in the fall class. The following two sections describe the case teaching methodologies employed by each instructor in his respective section.

The Fall 2000 IT Management Class

I assign a short, end-of chapter cases at least one week in advance. I ask the students to read the case and answer the questions included in the text after the case. The students' written (word processed) answers are turned in to me *after* the case is discussed in class. I make it very clear that their work is not graded in terms or "right or "wrong ; instead, I simply look at each paper to determine whether a thoughtful and justifiable response has been formulated. Once the cases have been turned in, I grade each student's work by assigning a check mark (✓) or minus (-) indicating whether I have deemed their work to be sufficient. Insufficient answers are relatively rare. Those receiving a check mark are given credit for all of the points for the assignment, while those who receive a minus receive no credit.

The written answers to the case questions serve as reference for the students as we discuss the case in class. Because of the availability of some written guidance, many of the students seem more at ease when they are called upon to contribute to the discussion. Also, I have noticed that students seem to be more prone to add to the discussion voluntarily when they have a well-formulated response in writing at their disposal.

I purposefully don't read the questions accompanying the case before the class discussion. Instead, I work up my own set of questions. My reasoning for this approach is that if I read the questions prepared for the case, I may actually constrain my own thoughts about the issues. I prefer to lead the discussion on what I feel is most important to emphasize. Only after I have exhausted my own list of questions for the class will I ask for responses to the given case questions if, in fact, we have not already covered the question in our discussion.

When I have a classroom that allows for rearranging the student seating, I ask the students to move their chairs into a circle. I also sit in the circle. This arrangement seems to improve the informality of the setting and is very conducive to group discussion.

Student comments, both formally through instructor evaluation reports and informally through discussion with individuals, have been very positive about the value of teaching cases in my classes. The anecdotal evidence for the success of this approach is strong but indirect.

The Spring 2001 IT Management Class

Inspired by a workshop hosted by Larry K. Michaelsen (see Michaelsen, 1997-1998) prior to the beginning of the semester and disappointed by the negative feedback I received from my spring 2000 class, I made several sweeping changes to my case study methodology. In spring 2001, I divided my class of 22 students into seven teams. I consciously used principles of demographic diversity as advocated by Trimmer, Van Slyke and Cheney [1999] in comprising the teams. I also ensured that there would be at least one "high-performing student on each team. The teams endured throughout the semester. Although Michaelsen strongly advocates giving students all the class time they need to operate in groups, I purposefully composed teams whose members shared some free time at some point during the week. Further, I encouraged teams to conduct e-meetings to discuss case questions and to prepare the final report.

Five case studies were assigned at the beginning of the semester, with case discussion to begin on the fifth week of the semester. The cases came from Turban (1999). Text questions for each of the five cases were supplemented with my own questions.

On each case studies day, the period began with all students taking a short multiple-choice quiz on the details of the case. As advocated by Michaelsen in his workshop, students then immediately grouped together in their teams to discuss the quiz and to retake it, this time as a group quiz. The quizzes served to motivate students to read the case carefully.

I then led the discussion of the case questions in a question-answer format. Students frequently enlivened discussion with vigorous debate, as opposing points of view were enthusiastically presented. Invariably, discussion would fill the remainder of the class period, and the following class period was dedicated to tying up the loose ends of the case.

One week after the case discussion concluded, each team submitted a written analysis of the case. At the end of the semester, all students rated the relative contributions of their teammates. Students were forced to give at least one teammate more points than the rest, a practice advocated by Michaelsen. Altogether, the case work (quizzes and reports) was worth 25 percent of the course grade. Forcing students to allocate points unevenly led to several students having their course grade elevated or demoted a level.

Instrument Development and Administration

We developed a 12-item questionnaire administered in the spring semester in a collaborative fashion. The instrument itself (see Appendix A) is designed primarily as an exploratory tool to assess the effectiveness of our approach to teaching case studies. We believe a basic value of the case approach is in the teaching of soft skills (Romm & Pliskin, 2000), which led to the development of questions two and six. We believe that the case approach is an excellent vehicle for teaching the Bloom's (1965) higher levels of learning, hence questions five, seven, eleven, and twelve. Because many of the changes in approach were inspired by Michaelsen

(1997-1998), we developed questions four, eight, and nine. We developed question three to assess students' perceptions of cases as agents of active learning, as suggested by Horgan (1999). Both instructors felt that cases were an important tool for teaching key issues, resulting in question one. Finally, we wanted to learn whether students preferred our new approach to the more traditional case approach, which accounts for question ten. The instrument concludes with two open-ended questions to explore issues not sampled by the first twelve questions.

At semester's end, students anonymously evaluated the case studies on a five-point scale. The results of this survey are shown in Table 1. Questions have been sorted from their original arrangement, to an order showing statements most strongly agreed with first.

The results of the survey indicate a widespread satisfaction with the approach to case studies. Our perception is that students like this case methodology much more than they did in the spring 2000 class. Students seem to be particularly satisfied with cases as tools for making abstract MIS principles concrete. Not surprisingly, the question which received the least support concerned the forcing of uneven ratings which led to some students receiving lower grades for the course than they otherwise would have. However, only two of the twenty-two students either disagreed or strongly disagreed with question nine.

TABLE 1
RESULTS OF CASE STUDIES QUESTIONNAIRE

Question Number	Question	Mean
7.	The cases provide students with a good means of applying information systems principles to real world situations.	1.36
1.	The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.	1.41
11.	The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.	1.45
12.	The cases provide students with a good opportunity to exercise evaluation skills, i. e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.	1.45
4.	Having both an individual quiz and a group quiz is a good idea.	1.55
2.	The cases are a good way of teaching "soft skills ; for example, interpersonal skills and management skills.	1.64
3.	Cases increase the likelihood of student participation in class discussion.	1.64
6.	Because much of the case work involved team work, the cases served as a good vehicle for applying principles of team management.	1.68
5.	Writing the case report aided in understanding the case principles.	1.73
10.	I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.	1.73
8.	Requiring students to assess relative contributions of team mates is a good way to motivate individual efforts.	1.77
9.	Requiring students to rate at least one teammate's contribution as better than average is a good idea.	2.41

Even the response to question ten was gratifying. This question, which ranked tenth in order of agreement, asked students to compare the spring 2001 approach with the traditional approach. Although three students rated the question neutral, not one of the twenty-two either disagreed or strongly disagreed with the statement.

The results of this questionnaire must be interpreted with caution. Apparent student satisfaction with the 2001 methodology does not ensure that the methodology was more effective. There could have been contaminating factors the students may have found that pioneering a new methodology was a positive experience. Or the instructor may have done a more effective job for all aspects of the course pulling the case study results up by the bootstraps, as it were. Nevertheless, the evidence does point to the 2001 methodology being more effective.

In addition to the twelve questions above, students were also asked to respond to these two open ended questions.

1. What is the one thing you liked best about our approach to cases this semester?
2. If you could change one thing about our approach to cases this semester, what would it be? How would you change it?

As might be expected, a number of students rephrased one or more of the twelve statements to indicate the greatest strength. As proponents of active learning, we are pleased to note that six students indicated that active class discussions were the greatest strength of this approach to case studies.

Even responses to the "greatest weakness question tended to be positive. In fact, five students indicated that there was no weakness with the 2001 methodology. Typical responses to this question included:

More than five cases should be used (2)

More in-class time should be allocated to cases (2)

Class should be 75-minutes rather than 50 minutes

Complaints tended to be about the cases themselves rather than to the methodology.

- Cases should be more current (2)

Cases should be more detailed

LESSONS LEARNED

While Brabston, et al. (1999) proposed the three models for collaborative team teaching as described earlier in this paper, we would like to propose a fourth, less radical model. We suggest a more formal approach to procedures that good instructors are already doing informally. We propose that when two or more instructors are assigned responsibility for the teaching of a particular class using case studies as a teaching tool, that these instructors routinely perform the following steps.

1. Compile a list of generally agreed upon desired outcomes from teaching the cases.
2. Construct a questionnaire designed to evaluate the processes used to achieve the outcomes.
3. Administer the questionnaire at the conclusion of each semester.
4. Meet to discuss questionnaire results; identify methodologies that best meet desired outcomes.
5. Incorporate appropriate methodologies in future classes.

We believe that, while no "one-size-fits-all when it comes to teaching methodologies, this process can only result in more effective teaching. A structured approach to evaluating methodologies from multiple instructors teaching a common course, as we have begun to do, should lead to a fine-tuning of individual teaching performance.

The case study format presents an excellent opportunity for instructors to collaborate in the determination of which methods and desired outcomes are most appropriate for a course. In this paper, we have presented a combination of anecdotal and empirical evidence of the benefits instructors (and, ultimately our students) can derive from the above model.

We believe this process can only result in more effective teaching. We believe that there is no one-size-fits-all teaching methodology, but we do believe a structured approach to evaluating our methodologies, as we have begun to do, should lead to a fine-tuning of individual teaching performance.

Particularly given the AACSB's emphasis on assessment (Williams and Price, 2000), we believe that our model of collaborative teaching should serve as an excellent springboard for improving instruction. The responses to questionnaire items are valuable, but the discussion they provoke is invaluable. We do not believe it is enough to simply divide students into groups to discuss case studies. The devil is in the details.

For example, if many students indicate that "lively discussion is a great strength of one instructor's approach, the positive response is not necessarily due to the content of the questions. Discussion of this item may reveal that lively student participation is a product of the instructor's serving more as a facilitator than as a leader. Discussion of these and other questions lead to synergistic improvements. Good teaching is certainly as much art as science, but it is an art enhanced by our collaborative procedure.

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APPENDIX A
CASE QUESTIONNAIRE

Name: ______________________________

Use the scantron to answer the first twelve questions below. Do not put your name on the scantron. You must write your name above in order to receive the ten points extra credit.

A: strongly agree   B: agree   C: neutral   D. disagree   E. strongly disagree

1. The cases brought out important points about managing information systems, such as the role of IS in a global economy, the potential of e-commerce, the role of IT in strategic planning, IT ethics, etc.
2. The cases are a good way of teaching "soft skills ; for example, interpersonal skills and management skills.
3. Cases increase the likelihood of student participation in class discussion.
4. Having both an individual quiz and a group quiz is a good idea.
5. Writing the case report aided in understanding the case principles.

6. Because much of the case work involved team work, the cases served as a good vehicle for applying principles of team management.

7. The cases provide students with a good means of applying information systems principles to real world situations.

8. Requiring students to assess relative contributions of teammates is a good way to motivate individual efforts.

9. Requiring students to rate at least one teammate's contribution as better than average is a good idea.

10. I prefer the approach to cases used this semester to the traditional case approach, i.e., when student teams are assigned the responsibility of presenting a particular case.

11. The cases provide students with a good opportunity to synthesize; that is, identifying potential solutions to a case problem and choosing the most appropriate solution.

12. The cases provide students with a good opportunity to exercise evaluation skills, i. e., appraising the extent to which particulars are accurate, effective, economic, or satisfying.

13. What is the one thing you liked best about our approach to cases this semester?

14. If you could change one thing about our approach to cases this semester, what would it be? How would you change it?

TEACHING WITH ONLINE CASE STUDIES: IMPLEMENTATION AND EVALUATION ISSUES

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ABSTRACT

The case study is one of the most widely used tools in many disciplines including Information Management. At the same time the new Internet revolution has promoted online distance learning courses as never before. Many online courses are also incorporating the benefits of case studies into their course content. Case studies are now available online and case discussions can be conducted using asynchronous and synchronous online discussion tools. The online case study, or cybercase is an innovative pedagogical tool, however, more research is needed in regards to the issues surrounding the implementation of online case studies. The main objective of this paper is to analyze the use of online discussion methods for case study discussion. It discusses background issues regarding online cases, and the method for conducting an online case discussion. In particular, it investigates the idea that online case studies can be powerful learning tools in a distance learning environment. This study compares and contrasts traditional case discussions versus online case discussions. Some of the important questions explored in the present research are What is the type of discussion that takes place in each setting? What is the level of discussion participation in an online case analysis? Is the quality of the discussions in online cases comparable to traditional discussions? What are the major similarities and differences in interaction and learning between an online case study discussion and traditional case discussion? and What is the most adequate instructor's role in the online case discussion environment?

INTRODUCTION

The case study is one of the most widely used tools in many disciplines including Information Management. The case study allows students to apply theoretical concepts to real world actual situations. Cases are an important component of the curriculum at important business schools (Tracy and Waldfogel 1997) such as Harvard Business School (Schmotter 2000, Chow 1992). At the same time the new Internet revolution has promoted online distance learning courses as never before. Many online courses are also incorporating the benefits of case studies into their course content. Case studies are now available online and case discussions can be conducted using asynchronous and synchronous online discussion tools. The online case study, or cybercase (Niederhauser 1999) is an innovative pedagogical tool, however, more research is needed in regards to the issues surrounding the implementation of online case studies.

The main objective of this paper is to analyze the use of online discussion methods for case study discussion. It discusses background issues regarding online cases, and the method for conducting an online case discussion. In particular, it investigates the idea that online case studies can be powerful learning tools in a distance learning environment. This study compares and contrasts traditional case discussions versus online case discussions. Finding a way to explain differences between electronic discussion and oral discussion has not been simple and many studies have compared multiple measures across both environments (LaGrandeur 1997). Some of the important questions explored in the present research are:

What is the type of discussion that takes place in each setting?

What is the level of discussion participation in an online case analysis?

Is the quality of the discussions in online cases comparable to traditional discussions?

What are the major similarities and differences in interaction and learning between an online case study discussion and traditional case discussion?

What is the most adequate instructor's role in the online case discussion environment?

In addition, this study looks at how the method used in online discussion can affect the learning outcomes for students involved in an online distance learning environment.

THE CASE STUDY METHOD

The case study is a means of bringing in greater realism into the classroom (Lapierre 1996). Cases can be written by academics (Summers et al. 1990) or practitioners (Kellog 1985). Most cases include a thesis and argumentation but not always a conclusion (Gini 1985). The instructor's primary role is to prompt when necessary to ensure that critical issues are not overlooked. The instructor can also summarize the discussion and draw out the useful lessons and observations (Hammond et al. 1999).

Advantages of the case study include:

- *Vicarious learning.* Participants learn as critics or observers too.

The lively interchange of ideas and opinions allows a much greater variety of interpretations of the case (Szpiro and Neufeld 1999). People can experience immediate feedback and reflect on their own perceptions (Niemyer 1995).

Motivation. Participants are more likely to remember concepts used to solve real-life problems and being able to apply concepts rather than just learning textbook theories (Andrews and Noel 1986). The whole phenomenon of case-method teaching motivates instructors as well (McCraw 1999).

Transfer. Cases give students experience that can be applied to subsequent cases, and on the job situations (Standridge 2000, Dorn 1999).

Active participation. Case studies require less lecturing and more active learning (Standridge 2000).

Cases yield generalizations and help students take ownership of knowledge (Robyn 1998).

Cases promote the development of critical thinking skills (Capella and Robin 1986).

However, there are also some disadvantages (Stonham 1995) that include:

Cases are highly dependent on the instructional and educational characteristics of the instructor.

Case discussion can be difficult for a large class size (Mostert and Sudzina 1996).

Some students may have difficulties with writing.

Some physical setting may not be appropriate for the discussion.

Level of class preparation and complexity.

Student inexperience with case analysis.

A written case does not fully convey the complexity of the real situation (Andrews and Noel 1986).

Cases are a less efficient way to communicate content than other methods (Fulmer 1992).

IMPLEMENTING AN ONLINE DISCUSSION

There are two major options for implementing an on-line case study discussion: synchronous and asynchronous. Several studies (Davidson et al. 2000) have analyzed the quality of online interactions, both in chat rooms (synchronous mode) and bulletin boards (asynchronous mode). Chat room discussion allows for immediate feedback, while bulletin board discussions encourage students to provide thoughtful responses to posted questions. In this study, the bulletin board discussion mode was used because participants can elaborate on their answers and provide more insightful thoughts, however, future studies should evaluate the use of chat rooms for case study discussions. The implementation of the online case discussion can vary depending on several factors including instructions given to students, discussion organization, instructor's participation, student participation requirements, and assessment of discussion participation (Bailey and Wright 2000).

The advantages of online discussions over face-to-face exchanges have been well documented in the research literature. Some of the advantages of online case studies include:

Online case studies can be linked to discussion boards, additional content material, online articles, web sites for additional information, or other resources.

Another dimension can be added by using online newspaper articles. Newspaper articles reflect the business conditions that decision-makers are facing (Schaupp and Lane 1992). Some online cases are even mainly based on newspaper or magazine articles that are available online. A progression of related news stories throughout a period of weeks could show the evolution of a major case issue.

All students have equal opportunity for participation. An online case discussion format can encourage timid students who did not participate in class to participate more actively and to express themselves. It is a more equitable, less stressful and non-threatening forum for discussions, especially for nonassertive personalities (Warschauer 1997).

Chat room discussion can overcome distance limitations by allowing external guests to participate in the case discussion. Students can prepare their questions ahead of time.

Participants can access the cases anytime over the Internet.

Accessibility, flexibility, group interaction, and opportunity for self-direction.

More available time to elaborate a response.

Online discussion can provide the opportunity for students to engage in thoughtful conversations, which may result in deeper understanding and greater learning gains (Irvine 2000). It encourages all students to formulate their thoughts at a deeper level (Bailey and Wright 2000).

Contributed responses become a repository available to other students.

Participants have more time to respond to answers because elapse time is much longer.

The amount of student contributions in comparison to instructor contribution is much higher.

Answers can be more elaborated, edited and carefully thought and phrased. Online discussions seem to promote rhetorical experimentation on the part of the participants (LaGrandeur 1997).

The same group can maintain simultaneously multiple discussions on different topics.

An online case discussion can be even more interactive than a traditional classroom case discussion.

The online instructor can selectively release content, can create multiple discussion groups, can provide private or public feedback.

A stimulus for increased written participation (Kern 1995).

An expanded access channel with possibilities for creating global learning networks (Cummins 1995). Online cases allow the participation of students from multiple countries in the same discussion therefore promoting a global perspective in education (de Wilde 1991). Online cases can be used in a multinational virtual environment (Zhao 1996).

Online cases do not have to be always presented in a written form (Niemyer 1995). Some online cases are multimedia rich and include audio and streaming video. Students should be able to re-expose themselves to the case description by re-playing, rewinding or by pausing the video case.

The implementation of online case discussion also involves major challenges such as:

Online discussion can be difficult for a large class size.

Some students may not be computer literate.

Hardware, software and other technical problems (Niederhauser 1999).

Lack of Internet access.

Limited availability of online cases.

The available bandwidth for a modem connection limits the size of video clips, sound clips, and inline images appropriate for an online case. As better technologies for streaming video become available, we should see more video cases available online.

THE CASE DIFFICULTY CUBE

Cases vary in terms of the volume and complexity of elements, some cases are full of facts, descriptions and quotes, other give little detailed information (Einsedel 1995). Some cases explicitly state the issues and problems, others do not, instead they provide symptoms or clues that suggest underlying problems (Einsedel 1995). Many authors have provided suggestions on effective use of different case study types, with different populations, and at different phases of learning (Romm and Mahler 1991). A different approach or objective calls for a different case type. The level of difficulty of a case can be determined by using the cube framework proposed by Erskine et al. (1981). The cube framework can be used to classify the different types of cases. The cube has three dimensions: analytical, conceptual, and presentation. Each of these dimensions can be divided into three degrees.

A. *The Analytical Dimension* This dimension is concerned with the task that the student must accomplish in the case. The three degrees of analytical difficulty can be summarized as follows:

Level 1. Both the problem and the implemented solution are described. Evaluate the appropriateness of the solution.

Level 2. The problem is defined, a feasible solution must be found.

Level 3. A situation is described, neither the problem, nor a solution are defined.

As the level of analytical difficulty increases, so does the required analytical skills.

B. *The Conceptual Dimension* This dimension describes the complexity of the fundamental theoretical concept(s) underlying the case.

Level 1. The concept, theory or technique is simple and straightforward. The concept or concepts in the case may be easily grasped by all the participants just by reading the case.

Level 2. The concept or theory is of medimu difficulty. It is a combination of concepts, or may require further explanation by the instructor.

Level 3. The concept is difficult, cross-functional or complex. Requires the active participation of the instructor to explain some of the concepts.

C. *The Presentation Dimension* This dimension is related to the amount of information that is given and how it is presented.

Level 1. The amount of information required for analysis is small. The case is relatively short. The information is presented in a clear and straightforward way. There is almost no extraneous information in the case.

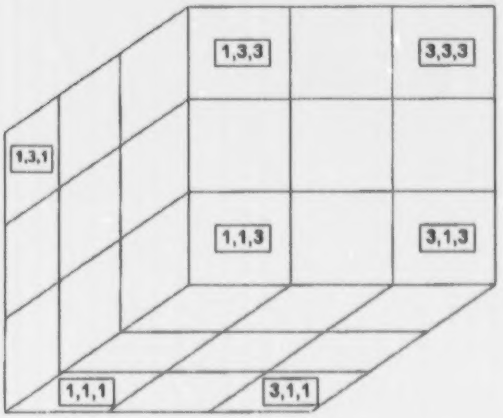
Level 2. The case length is average, the information is clearly presented and some extraneous data is included in the information.

Level 3. The case contains a large amount of information. The information may not be clearly presented, or they might be critical information missing. The case might include a large amount of extraneous information and may be less organized.

Figure 1 shows the Case Difficulty Cube (Erskine et al. 1981) and its three related dimensions. A case-based course would begin with cases ranked lower in difficulty along all three dimensions and gradually increase the level of difficulty along all three dimensions. The total number of combinations in the cube is 3 x 3 x 3 = 27.

One of our objectives is to determine how cases with various levels of complexity can be implemented as an online case study. Could certain dimension levels be

FIGURE 1
CASE DIFFICULTY CUBE



more suitable to an online case discussion? The implications for implementing an online discussion for a simple case might be different from implementing an online discussion for a complex and lengthy case. Therefore, in this study we implement online case discussions for varied case types. We decided to use multiple versions of the same case, instead of using multiple cases in order to provide some level of comparability. The same case is adapted to the particular dimension. In the present study we have simplified the framework for implementation purposes, and used only two levels for every dimension. The number of different case versions in this study is 2 x 2 x 2 = 8.

The case used in this study is called "Tradenet: Singapore's Computerization of International Trade, by B. S. Neo (1994). A modified version is available online.

A. *The Analytical Dimension*

Level 1. Both the problem faced by Singapore and the implemented solution are described. Students are expected to evaluate the appropriateness of the Tradenet solution.

Level 2. The problem faced by Singapore is defined, but the information related to the implemented solution was eliminated from the case. Students must figure out a feasible solution.

B. *The Conceptual Dimension*

Level 1. The focus of the case is on simple concepts such as the definition of EDI. Higher order concepts were removed from the original case version.

Level 2. The original case deals with more complex concepts such as defining a vision, co-operation, technology diffusion, partnership, focus effort, strategic alignment of information technologies, integration, implementation, stakeholder participation and identification of business needs. Specific lessons learned for each concept are described.

C. *The Presentation Dimension*

Level 1. All extraneous information was removed from the case. The case was made as short as possible without removing any relevant or important information.

Level 2. This version has the original case length.

Table 1 shows the eight different versions of the case. By modifying the case we were able to use the same case to represent multiple case types.

TYPES OF QUESTIONS BASED ON BLOOM'S TAXONOMY

As teachers we tend to ask questions in the "knowledge category 80% to 90% of the time. These questions are not bad, but using them all the time is. Try to utilize higher order level of questions. These questions require much more "brain power and a more extensive and elaborate answer. Below are the six question categories as defined by Bloom (1956).

Write questions that test skills other than recall. Research shows that most tests administered by Faculty rely too heavily on students' recall of information (Milton, Pollio, and Eison, 1986). Bloom (1956) argues that it is important for tests to measure higher learning as well. Fuhrmann and Grasha (1983, p. 170) have adapted Bloom's taxonomy for test development. Here is a condensation of their list and the kind of questions you should ask to measure each category.

TABLE 1
CASE VERSIONS AND DIMENSIONS

Case Version	*Analytical Dimension*	*Conceptual Dimension*	*Presentation Dimension*
111	1 (decision made)	1 (basic concepts)	1 (short version)
112	1 (decision made)	1 (basic concepts)	2 (long version)
121	1 (decision made)	2 (medium difficulty concept)	1 (short version)
122	1 (decision made)	2 (medium difficulty concept)	2 (long version)
211	2 (decision to be made)	1 (basic concepts)	1 (short version)
212	2 (decision to be made)	1 (basic concepts)	2 (long version)
221	2 (decision to be made)	2 (medium difficulty concept)	1 (short version)
222	2 (decision to be made)	2 (medium difficulty concept)	2 (long version)

TABLE 2
BLOOM'S TAXONOMY

KNOWLEDGE (common terms, facts, principles, procedures) remembering memorizing recognizing recalling identification recalling information who, what, when, where, how ...? describe	**COMPREHENSION** (understanding of facts and principles, interpretation of material) interpreting translating from one medium to another describing in one's own words organization and selection of facts and ideas retell...
APPLICATION (solving problems, applying concepts and principles to new situations) problem solving applying information to produce some result use of facts, rules and principles how is ... an example of ...? how is ... related to ...? why is ... significant?	**ANALYSIS** (recognition of unstated assumptions or logical fallacies, ability to distinguish between facts and inferences) subdividing something to show how it is put together finding the underlying structure of a communication identifying motives separation of a whole into component parts what are the parts or features of ...? classify ... according to ... outline/diagram ... how does ... compare/contrast with ...? what evidence can you list for ...?
SYNTHESIS (integrate learning from different areas or solve problems by creative thinking) creating a unique, original product that may be in verbal form or may be a physical object combination of ideas to form a new whole what would you predict/infer from ...? what ideas can you add to ...? how would you create/design a new ...? what might happen if you combined ...? what solutions would you suggest for ...?	**EVALUATION** (judging and assessing) making value decisions about issues resolving controversies or differences of opinion development of opinions, judgements or decisions do you agree that ...? what do you think about ...? what is the most important ...? place the following in order of priority ... how would you decide about ...? what criteria would you use to assess ...?

TABLE 3
QUESTIONS TYPES IN EACH CATEGORY

KNOWLEDGE	COMPREHEND	APPLICATION	ANALYSIS	SYNTHESIS	EVALUATION
Define	Convert	Demonstrate	Diagram	Categorize	Appraise
Describe	Defend	Modify	Differentiate	Combine	Compare
Identify	Distinguish	Operate	Distinguish	Compile	Conclude
Label	Estimate	Prepare	Illustrate	Devise	Contrast
List	Explain	Produce	Infer	Design	Criticize
Match	Extend	Relate	Point out	Explain	Describe
Name	Generalize	Show	Relate	Generate	Discriminate
Outline	Give examples	Solve	Select	Organize	Explain
Reproduce	Infer	Use	Separate	Plan	Justify
Select	Predict		Subdivide	Rearrange	Interpret
State	Summarize			Reconstruct	Support
				Revise	
				Tell	

TABLE 4
QUESTION CATEGORIES IN EACH CASE VERSION

Case Version	Knowledge	Comprehend	Application	Analysis	Synthesis	Evaluation
111	✓✓	✓✓				✓
112	✓	✓✓✓			✓	
121	✓	✓		✓✓	✓	
122	✓	✓✓		✓		✓
211	✓	✓		✓✓		✓
212	✓	✓		✓	✓	✓
221	✓	✓		✓	✓	✓
222	✓	✓		✓	✓	✓

Many faculty members have found it difficult to apply this six-level taxonomy, and some educators have simplified and collapsed the taxonomy into three general levels (Crooks, 1988): The first category knowledge (recall or recognition of specific information). The second category combines comprehension and application. The third category is described as "problem solving, transferring existing knowledge and skills to new situations.

Another objective of this study is to determine which question categories are easier to implement in an online case discussion. The implications may vary if you are answering a simple Knowledge category question or answering a difficult synthesis question. Therefore, in this study we use questions from every category from Bloom's taxonomy. We came up with a list of 40 different questions. Each one of the eight case versions has five totally different questions from multiple categories. For example, case version 212 includes one knowledge question, one comprehension question, one analysis question, one synthesis question, and one evaluation question.

IMPLEMENTATION OF THE STUDY

This case study was administered to 90 students in a junior computer information systems class during Spring 2001. The student formed their own teams of three students each based on their own preferences. Each team was assigned a different version of the Tradenet case at random. Every team had a separate bulletin board area for discussion. Students could only see postings from their own team members.

The content of the course included 9 short cases. These cases were discussed several weeks prior to the TRADENET case, therefore, students were already familiar with online case study discussion and with posting techniques. Several versions of the TRADENET case study were posted along with guided questions. Data sources for this study include responses to case studies, interactions between students, and feedback survey results. Data sources consist of transcripts of all online case discussions, results of a feedback attitude surveys and a computer background survey.

STUDENT EVALUATION OF THE CASE DISCUSSION

A previously used method to evaluate the effectiveness of the case study discussion is to use an evaluation questionnaire (Raju et al. 2000, Raju et.al. 1999). A student survey was conducted at the end of the semester to assess the effectiveness of the online case discussion and to evaluate the students' perceptions of the case discussion Student were encouraged to be honest and completion of the questionnaire was completely optional. A total of 74 students completed the evaluation questionnaire. Students were also surveyed regarding their computer background and Internet skills, as well as their attitudes toward online learning.

TABLE 5
MEAN RATINGS FOR ITEMS

ITEM	MEAN
I improved my understanding of basic EDI concepts after reading the case.	4.10
I learned to value other students' point of view.	3.96
I learned to inter-relate important topics and ideas after reading the case.	3.94
The case improved my ability to integrate. technical and managerial issues	3.90
The case has helped me become more confident in expressing ideas.	3.89
My ability to evaluate critically technical and managerial alternatives has improved.	3.83
I feel my ability to integrate technical and managerial issues has improved.	3.81
The case motivated me to learn more about EDI.	3.74

The first part of the questionnaire asked the respondents to indicate the extent of their agreement with 8 evaluatory statements on a 5-point Likert scale. The response scale ranged from 1 which represented the least favorable response of strongly disagree, to 5 which represented the most favorable response of strongly agree. The following table illustrates the overall positive reaction to the various aspects of the TRADENET case study. The reaction of the students to the case was favorable, all questions yielded means of 3.7 or above. In other words, the students positively rated all items.

TABLE 6
MEAN RATINGS FOR
KEY DESCRIPTIONS OF CASE STUDY

THE CASE WAS...	MEAN
interesting	4.17
relevant	4.14
helpful	4.04
useful	4.03
meaningful	4.01
appropriate	3.99
valuable	3.94
clear	3.94
important	3.93
practical	3.90
engaging	3.90
challenging	3.82
easy to understand	3.82
exciting	3.49
difficult	3.01

ANALYSIS OF DATA

Every posting was analyzed to determine the quality of the contribution and whether participation was substantive (Davidson-Shivers et al. 2000). A full analysis of each question was made. The criteria used for assigning points (grades) to the answers was based on the following three levels.

Level 3: The answer is specific and thorough

Level 2: The answer has been attempted but the answer is clearly lacking in thoroughness

Level 1: The answer has been attempted

The complete statistical of the data will be provided in the final version of this paper.

SUBSEQUENT ANALYSIS

In a study by LaMaster and Morley (1999) participants were encouraged to respond to the cases and questions by posting replies. Students enjoyed the general forum, with all messages posted to one main site, while mentors preferred small group forums.

A study by Steinkuehler et al. (2000) compared the effects of three forms of online instruction on memory, belief change, and argumentation skill. Reading of a pro/con text was followed by: (1) online discussion in pairs compared to reading of the same text followed by two forms of individualized study techniques derived from the cognitive memory literature; (2) self-explanation; and (3) repeated summarization and study. Results were analyzed in terms of argument change from pretest to posttest, transfer of argument skills, text recall, reported and directly assessed opinion change, and perceptions of productivity and participation. Qualitative analysis of the transcripts from the online activities examined time on task, effects of pair agreement or disagreement, and unequal participation within the pairs.

Other methods used for data analysis include the constant comparative method (Murphy et al. 1998). Another study by McDonald (1998) focused on the following variables.

the level (quantity) of participation

the relationship among and between messages

the functions of the interactions (cognitive, meta-cognitive, social, organizational) and determine if the pattern of those functions changed

the characteristics and patterns of interpersonal interactions

We will apply content analysis techniques to the transcribed discussions in order to examine several variables, including level of participation, amount of interaction, and cognitive skills. Transcripts of the case answers will be analyzed within and across groups using a coding scheme based on a content analysis model for dimensions of the learning process by Henry (1992). We will also generate a set of code words found in each case discussion and visual maps (latice graphs) with conceptual hierarchies to relate this data. Content analysis of computer-mediated communication has been used in previous studies of online discussions (Hara et.al. 2000).

CONCLUSION

This paper has described the unique aspects of online case studies and major advantages and disadvantages. The framework for this study has been described in detail. Analysis of the data is currently in progress. Results from this research-in-progress should provide insights about the level of discussion participation in an online case analysis, the quality of the discussions in online cases. Other issues include interaction and learning in an online case study discussion and the role of the instructor in the online case discussion environment.

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REQUIRING STUDENTS TO BRING COMPUTERS TO CAMPUS: ARE UNIVERSITIES ACHIEVING THEIR GOALS?

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ABSTRACT

According to data from the Campus Computing Project, an independent annual survey of colleges' information-technology plans, less than 10 percent of colleges and universities currently require students to have their own computers. ("Growing Number of Colleges...," 2000) However, as universities fight to secure a competitive advantage for both themselves and their graduates in the 21st century, more institutions will be joining the ranks of those currently placing a desktop or a laptop in the hands of each co-ed. The goal of this paper is to poll the current thoughts of universities that do have such a requirement in place, of universities that are considering adopting a policy requiring computers in the near future, and of universities that have chosen not to jump on this band wagon. This paper will explore the technology objectives of these universities and attempt to determine if these objectives are being met through universities' current computer ownership requirements.

INTRODUCTION

As the computer screen replaces the notebook, a growing number of universities, both private and public, are requiring that students either purchase or lease their own computers, adding at least $1000 per year to the average cost of college expenses (Port, 1999). For freshman at the University of North Carolina at Chapel Hill, the choice was whether or not to pay $2182 for a standard ThinkPad or $2924 for a model with expanded memory and a larger hard drive. On some campuses of the Polytechnic University in New York, students are paying $500 each semester to lease a laptop ("Growing Number of Colleges...," 2000).

Some schools are requiring the purchase of specific hardware and software. Others are supplying minimum computer configurations appropriate to different degree programs. (University of Florida: Student Computer Requirement's web site, 2001).

While the students may bear some of the financial burden, states are investing heavily to create a technology-enabled environment. In Massachusetts the Board of Higher Education approved a $123 million program that includes vouchers for low-income students and training, facilities, equipment, and academic programs ("Massachusetts Takes Step..., 2000). The plan unconditionally embraces technology at a time when educational specialists are still trying to ascertain how computer ownership impacts education. The Board of Higher Education deemed this to be a necessary step in ensuring graduates will have the technological skills to fill tens of thousands of business and high-tech job openings (Healy, 2000). However, this program has stalled for lack of funding and public support. The board had anticipated financing the program with state-issued bonds. The state IT division ruled against bond financing. Because computers rapidly become obsolete, monies will have to come out of general revenues. Events such as the evaporation of the state's surplus and the public's reaction to the cost have stalled the Board of Higher Education's plans (Olsen, 2001).

Benefits

All students will have the same academic advantage. Typically students who qualify for financial aid are less likely to have the means to purchase computers. If technology is a university requirement, the cost can be factored into financial aid packages. Some universities are using special endowments or have redirected some revenue monies to help students meet these costs ("Growing Number of Colleges...," 2000).

The network and communications that these computers provide can improve faculty/student communications. Skills acquired while using the computers would provide real skills which would make graduates more marketable (Graf, 2000). Software could be obtained at reduced prices with a campus site license (Gates, 1998).

Courses offered in all majors will be able to incorporate the use of technology (University of Denver: 2001 Laptop Specifications web site, 2001). On some campuses, freshman are required to attend training sessions so that they will be able to use and configure the computers and will be prepared for class work and/or assignments (Lawrence, 1999).

In the case of wireless LAN technology, students can access a course material or e-mail faculty while sitting on a bench outside the library. Many believe that the greatest benefit of requiring computers comes from outside the classroom, where students have 24-7 access to campus network and the Internet (Olsen, 2001) Technology has elbowed its way out of computer labs. Universities can reclaim scarce physical space that once housed these labs. No more spending of endless dollars to rewire old building with asbestos ceilings and cinder block walls to meet changing technology needs. At Wake Forest this year, freshman received a wireless Ethernet card with their PC notebook, and a bill with their tuition statement. Approximately 11 percent of Carnegie Mellon's students purchased wireless LAN cards with which to access the university's wireless network (Brewin and Cope, 2000).

Faced with stagnant enrollment and low SAT scores, Western Carolina University implemented a plan to wire campus and require computers in 1995. Students may choose to purchase a desktop or a laptop. While enrollment has not climbed, the quality of the student has. SAT scores are on the rise as WCU emphasizes communications skills and critical thinking, not computer hardware (Johnson, 2000).

While most administrators agree that they are unable to measure the real impact of computer ownership on education, this policy will impact the institution's bottom line. Spending on information technology can be greatly reduced for the institution as these costs are passed on to the student (Olsen, 2001).

Concerns

Not everyone agrees that student ownership of computers is necessary. Everyone does agree that networks must be improved to accommodate increased traffic, the student's cost of education will rise, and both faculty and students will need additional training (Graf, 2000).

Security and battery life require thought and planning for universities that wish to embrace wireless technology (Brewin and Cope, 2000). Some faculty also worry about the integrity of using high-tech electronic devices in the classroom (Kobin, 2000).

Others are concerned about the added financial burden to students (Port, 1999). Chris Duckenfield, vice provost for computing and information technology at Clemson University, believes that it is unfair to require students to spend money on technology that will be obsolete in two years. In 33 labs across campus, Clemson has 800 computers available that can be configured to suit the user. Students do not have to invest in their own machine, they do not have to lug machines around, and equipment cannot be stolen ("Clemson Develops System," 1998).

Students at some universities that require computer ownership have been disappointed. The computer requirement brought with it the expectation that computers would be used in some, if not all, classes. In fact, few classes are computer intensive. Restructuring courses takes commitment and time for faculty members to create course content that is electronic (Olsen, 2001).

RESEARCH QUESTIONS

One goal of this paper was to survey universities with computer requirements and determine what their objectives were when these universities decided to embrace a technology requirement. The survey instrument then asked if these objectives are being met, and if not, why not. The instrument also asked the universities if they were experiencing any unexpected outcomes, good or bad, and if so what these outcomes are (i.e., change in enrollment or retention, etc.).

Another goal of this paper was to poll universities who have not begun requiring students to arrive on campus with computers in tow. Are they considering imposing a technology requirement? If so, what are the driving forces behind this decision? If not, why not?

A driver behind this project was the strategic planning process currently underway at the authors' university. The information technology plan task force has directed the university to consider requiring students to purchase/lease laptop computers. This requirement would supplement or replace the current environment which makes 1400 computers at various locations on campus available for student use almost continuously during academic sessions. In addition, most student residence halls are wired for connection to the campus LAN. Plans are underway to make older residence halls "connected" via wireless technology.

METHODOLOGY

Although the authors are primarily interested in the computer ownership requirements at peer institutions, we decided to use the *Chronicle of Higher Education* listing of colleges/universities as our frame ("How the Classification...", 2000). A stratified random sample of 20 percent of the frame was selected from doctoral-granting institutions (total of 151 extensive, 110 intensive), master's colleges and universities (total of 496 at level I, 115 at level II), and baccalaureate colleges (total of 228 liberal arts, 321 general, and 57 baccalaureate/associate). The provost/academic vice president at each selected institution was contacted via e-mail with a link to a web-based survey. If electronic contact could not be made, a letter was sent with an enclosed hard copy version of the survey. A follow-up contact was made via e-mail/mail approximately two weeks after the initial contact.

RESULTS

Forty-one private institutions and 59 public institutions responded to the survey. These 100 responses out of the 295 surveyed renders a response rate of 33.9 percent. Of these 100 colleges and universities, 23 are doctoral-granting institutions, 39 are master's colleges and universities, and 38 are baccalaureate colleges. Most (62 percent) were institutions of 5000 students or less. Table 1 shows the breakdown of respondents by size of student body.

TABLE 1

Size of Student Body	Frequency
less than 5000	62
5000 - 10,000	19
10,001 - 19,999	9
20,000 - 30,000	5
over 30,000	5

Thirteen of the 100 institutions that completed the survey instrument required students to own or lease their own computers. Of those requiring all students to have their own computers, 64 percent make this requirement for students in every degree program. The remainder of those surveyed have this requirement in place for only some of their programs.

One-third allow students to lease computer equipment, 40 percent require that students purchase computer equipment. The remainder of institutions which require students to have computers leave the decision to buy versus lease up to the students. Two-thirds of these schools specify that the computer must be a laptop computer.

Roughly 62 percent of those mandating students must have their own computers have had this requirement in place for 2 to 3 years. Eighty-three percent believed this endeavor has been successful. None of the institutions considered the mandate to not be successful.

Of those not currently requiring computer ownership by students, most were not considering changing this policy in the near future. For a breakdown of responses, see Table 2.

Chi-square goodness of fit tests were conducted for those institutions which have computer requirements in place to allow a comparison by institution (private versus public), type (doctorate-granting institutions, master's colleges and universities, baccalaureate colleges), and size of student body. Only one of these tests yielded a difference that can be considered to be significant. Fifty-six percent of those schools with a student body between 10,001 and 19,999 require students to come to campus with computers. All other categories of schools based on size of student body had fewer than 12 percent of responding institutions mandating that students must own or lease a computer (p = .002).

Table 2

Future Plans	Percent
Currently planning to implement computer requirement	3.6 %
Currently considering to implement computer requirement	27.4
Not considering such a requirement	69.0

CONCLUSIONS

This study did not culminate in any definitive results. It did provide us with some initial information concerning the percentage of institutions that are mandating students arrive with computers and some insight into the successes, failures, concerns, and limitations of these programs.

In our survey instrument we asked for a contact person at the university who would be willing to talk with us and provide a clearer picture of what is happening at the institution. Our next step in this research will be to contact these people and discuss their decision whether or not to mandate that students have computers and the reason(s) their institution made this decision. For those who chose to require computers, we would like to know the goal of their program and whether or not it is being achieved.

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USING THE WEB AS A STRATEGIC RESOURCE: AN APPLIED CLASSROOM EXERCISE

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ABSTRACT

This paper reports the findings of an experiment designed to test extensions of the Technology Acceptance Model (TAM) within the context of using the World Wide Web to gather and analyze financial information. The proposed extensions are three-fold. Based on prior research, cognitive absorption variables are posited as predeterminants of ease of use. Similarly, cognitive instrumental variables are used as antecedents of usefulness. Finally a newly proposed construct, strategic importance, is used to capture perceptions of application relevance that are not personally motivated. While mixed support was found for the cognitive absorption variables, the cognitive instrumental variables were found to be strong predeterminants of usefulness. The relationship between usefulness and strategic importance was found to be highly significant; however, additional analysis indicated that strategic importance was a precursor rather than an effect of usefulness. The effects of adding strategic importance to the cognitive instrumental variables is also discussed.

INTRODUCTION

The information systems (IS) survey course, as a traditional staple of the undergraduate business school curriculum, is often the only exposure that non-IS majors have to concepts and issues relating to the use and management of information technology as a resource. Course objectives typically include:

- Gaining an appreciation for the strategic importance of information systems within the business environment;
- Developing an understanding of information technology that enables the student to leverage capabilities developed within their own discipline when working with information technology professionals; and
- To the extent that a hands-on lab component is offered, increasing competencies in office productivity tools.

In theory, these three objectives are interrelated. An appreciation for the strategic implications of information technology serves as an antecedent motivator for students to tackle the more technical aspects of the course. Likewise, the hands-on component is designed to reinforce technical understanding.

Two factors, however, may impact the first objective in ways that impair the ability to motivate students. First, technological advances in business communications, most notably those driving enterprise systems, inter-firm networks and e-businesses, increase the complexity of IS architectures in ways that are difficult to replicate in an education setting. Second, non-IS majors (and often, IS majors at the beginning of their discipline) are lacking not only technical skills, but also business knowledge that enables them to frame IS as an important resource.

Yet an appreciation for the strategic role of IS is more necessary than ever, as businesses are using communications technologies to open up the "black box" of the firm both to customers and suppliers. Non-IS business majors are impacted in the sense that they are likely to be content providers for internal and external web information systems. The ever-widening audience for business information increases the responsibility of business students as future information providers to understand the sources of data, the application software used to manipulate and infuse data with meaning, and the communications technologies that create access to that data.

The purpose of this paper is to propose a hands-on assignment intended to enhance student awareness of the Internet as a strategic resource. At present, the assignment has been developed as a pilot initiative; however, a set of measures based on a modified version of the Technology Acceptance Model (TAM) has been used to gather preliminary data on its effectiveness in changing student intentionality regarding future Internet use. The following sections discuss the adoption and modification of the TAM model, the measures and the implementation methodology within a single classroom setting.

THEORY AND MODEL DEVELOPMENT

Since its inception in 1989 (Davis), the Technology Acceptance Model has proved to be a robust descriptor of two factors—perceived usefulness and perceived ease of use—leading to user acceptance of new technologies. Two aspects of web information systems; content (*usefulness*) of the material, and hyper mediation (in which *ease of use* is an important factor) echo the pre-determinants of technology acceptance as posited by the Technology Acceptance Model (TAM). While this study uses an extension of the TAM model as a theoretical basis for assessing the value of these assignments, it should be emphasized that in this case, the focus is not on pure technology acceptance. Typically, students have already been using the Internet for some time, although largely for entertainment and peer-to-peer communications. Therefore, the shift in use represents an *adaptation* of an existing, well-known technology to change student perceptions regarding its strategic usefulness. Second, the dependent variable of user intention, has been separated into two variables to capture (1) intent to use web-based technologies for gathering and analyzing financial information, and (2) increased understanding of web information content as a strategic resource.

Subsequent research (Venkatesh, 1999; Venkatesh and Davis, 1996; 1998; Agarwal, Karahanna, 2000) extended TAM to incorporate additional pre-determinants of both usefulness and ease of use, and to examine the effects of intrinsic and extrinsic motivation. For example, Venkatesh and Davis (1996, 1999) explored the role of computer self-efficacy as an anchor for initial ease of use perceptions, finding that an individual's "comfort level" with computers in general affects their perceived ease of use before and after direct experience with new technology. This suggests that exercises designed to enhance general computer self-efficacy are an important complement that solely demonstrates systems usability.

The dramatic increase in web-based applications has led to corollary research on the intrinsic motivation properties of hyper mediated learning environments. Hyper mediated technology—such as that found in Internet applications and gaming software—provides a holistic experience in which informational aspects are augmented by visual cues that create enjoyment and "flow." Again, using TAM as the basis for examining possible antecedents of ease of use and usefulness, Venkatesh (1999) found that a game-based training intervention promoted a higher user acceptance of group collaboration software than traditional training. Not only was playfulness not a detractor, but also contrary to prior TAM research, the effect of perceived ease of use on the behavioral intent was greater than the inherent usefulness of the collaboration software.

Agarwal et al., (2000) extended this research by examining the effect of cognitive absorption, the state of focused and intense involvement with software, as a potential mediator of playfulness and personal innovativeness as predictors of user acceptance. Using survey results of perceptions of the World Wide Web as the target technology, cognitive absorption was measured as a set of variables, including *curiosity, control, temporal dissociation, focused immersion* and *heightened enjoyment*. The results indicate that playfulness and personal innovativeness were, in fact, fully mediated by the cognitive absorption response elicited from using the Web. In addition, the inclusion of cognitive absorption as direct predictor of behavioral intent in a separate test proved significant.

With regard to perceived usefulness, Venkatesh and Davis (1998) have posited two separate constructs as possible antecedent factors to further delineate the perception that a given technology is useful. The two constructs reflecting different aspects of a work experience that might lead an individual to regard a new technology as potentially useful are:

- Social influences (*subjective norms, voluntariness, and image*) relate to possible effects of adopting a new technology on personal interactions within a work environment.
- Cognitive instrumental processes (*job relevance, output quality, and result demonstrability*) potentially influence an individual's assessment of the effectiveness of a technology in meeting their specific job information requirements.

Using a longitudinal experimental technique, all six factors were found to be significant determinants of perceived usefulness, although the social interaction influences tended to be mediated by direct experience.

Given that these studies infuse TAM with a richer theoretical basis for understanding factors that might affect user adoption of a new technology, this study assesses a web-based training exercise, incorporating aspects of the previous research. Specifically, the components relating the cognitive instrumental process variables have been selected as having the greatest relevance to the objectives of creating a learning experience that students will find personally relevant, in terms of giving them strategic personal financial information. Because the exercise uses a graphical and hypermediated environment, the variables measuring cognitive absorption are also included. The experiment tests the following:

H_1 Heightened usefulness and ease of use perceptions leads to increases in the intent to use the Web as a tool for gathering and analyzing personal financial information.

H_2 Tasks that incorporate hyper mediation heighten the properties of cognitive absorption and strengthen ease of use perceptions.

H_{3a} The focus of using the Web as a tool for gathering and analyzing financial information increases user perceptions of the dimensions captured by the cognitive instrumental process variables, with a corresponding increase in perceived usefulness.

H_{3b} Heightened usefulness perception of the Web as a tool for gathering and analyzing financial information also increases the perception of its value as a strategic business resource.

The following model depicts the original Technology Acceptance Model relationships and the proposed extensions for the cognitive absorption, and instrumental variables.

METHODOLOGY

The goal of the exercise was to both introduce students to various types of web-based tools that can be used to gather and analyze financial information and to convey the idea that such tools can provide individuals and businesses with a strategic advantage. The three tasks were:

(1) Use of an intelligent search agent to find and evaluate various online booksellers. Because the search agent canvasses booksellers in Europe and Canada as well as the U.S, an ancillary step of the task was to verify the exchange rate.

(2) Use of two decision support tools in making a use car purchase decision. The two tools were quite different; one is an intuitive graphical interface, the second a more familiar text entry style tool. Students were instructed on the use of the two tools, comparing ease of use and results.

(3) Acquisition of the student's own credit report. For privacy reasons, this task was entirely voluntary, and the assessment of the students is limited solely to their perception of amount and extent of information available.

The empirical test of the exercise involved a single computer lab session conducted across multiple undergraduate student groups. Half of the students received the treatment exercise, and the other half a trivial web information gathering exercise. All students were given a survey questionnaire immediately upon completing the instructional session to determine initial levels of computer self-efficacy, and to establish baseline results on the parameters of cognitive absorption and cognitive instrumental variables.

The survey questions to determine levels of student cognitive absorption were adapted from a similar instrument used by Agarwal and Karahanna (2000) and include their five variables. The remaining questions elicited student perceptions of the cognitive instrumental variables; perceived usefulness, ease of use, and intentionality as derived from Venkatesh and Davis (1998). Finally, three items measuring perception of the strategic importance of the web as a financial analysis tool were developed specifically for this exercise. All items were measured on a seven point scale with strongly agree and strongly disagree as the endpoints.

An initial analysis of the instrument psychometric properties indicated acceptable levels of internal validity for the scales measuring the cognitive instrumental variables, perceived ease of use, usefulness, intention and strategic importance. The scales developed for the three of the cognitive absorption variables (temporal disassociation, heightened enjoyment and control) demonstrated at least one item with low internal correlation. In examining these items further, it was found that the two items for temporal disassociation (*"Most times when I get on the Web, I end up spending more time than I had planned", "I spent more time on the Web assignment than I had intended")* measured a slightly different dimension—that of devoting more time to the activity than originally intended. While this dimension was appropriate in the Agarwal study which examined general web use, the items did not fit the experimental setting with its specified assignment. Each of the problematic items for heightened enjoyment and control were the result of reverse coding. Dropping these items substantially improved Chronbach alpha coefficients (Table 1). The resulting scales are included in Appendix A.

TABLE 1
SCALE RELIABILITIES

Scale	Number of Items	Reliability
Behavioral Intention	3	.758
Perceived Usefulness	4	.869
Perceived Ease of Use	4	.799
Strategic Importance	3	.876
Information Quality	2	.769
Result Demonstrability	4	.806
Personal Relevance	3	.782
Temporal Dissociation	3	.819
Focused Immersion	5	.772
Heightened Enjoyment	3	.924
Control	2	.764
Curiosity	3	.837

DATA ANALYSIS AND RESULTS

To gauge the effect of each variable individually, single variable regressions were conducted for each of the cognitive absorption and instrumental variables on the corresponding TAM variable and on the independent variable of strategic importance. Multiple regressions were also conducted to ascertain the composite effect of the independent variables.

Hypothesis H_1, which posits ease of use and usefulness as antecedents of intention to use a given technology, is a straightforward application of the TAM in the context of using the web to gather and analyze financial information. The results indicated mixed support. Individually, both usefulness and ease of use were shown to be significant predictors of the intention to use the web (Table 2). The composite model was also highly significant ($p < 0.0001$), with an R-squared of 0.584; however, ease of use switched a positive to a negative affect on behavioral intention.

With regard to the cognitive absorption variables (H_2), the results of the single regressions (Table 3) indicate that three of the variables: temporal dissociation, heightened enjoyment, and control were positive determinants of strengthened perceptions of ease of use within the context of gathering and analyzing financial information. In a multiple regression assessing the composite model, however, only temporal disassociation and control remained significant. Curiosity became highly significant, but in the opposite direction of the hypothesized relationship. While the composite model was significant, it explained only 30% of the variation in perceived ease of use. These findings only partially support hypothesis H_2 that tasks incorporating hypermediation heighten the properties of cognitive absorption with a commensurate effect on ease of use perceptions.

TABLE 2
RELATIONSHIP OF PERCEIVED EASE OF USE, USEFULNESS WITH INTENTION TO USE

	Individual Variable Effects		Composite Model Effects	
	β	t	β	t
Perceived Ease of Use	.527	5.57***	-.228	-1.94*
Perceived Usefulness	.758	10.65***	.935	-8.15***
Effect of Ease of Use on Usefulness	.807	12.07***		
				$R^2 = 0.584$***

*p < 0.10 **p <0.05 ***p < 0.01

TABLE 3
RELATIONSHIP OF COGNITIVE ABSORPTION VARIABLES WITH PERCEIVED EASE OF USE

	Individual Variable Effects		Composite Model Effects	
	β	t	β	t
Temporal Dissociation	.237	3.43***	.175	1.66*
Focused Immersion	.088	1.00	-.077	-0.86
Heightened Enjoyment	.204	3.16***	.073	0.57
Control	.377	4.98***	.428	3.56***
Curiosity	.102	1.35	-.319	-2.77***
				$R^2 = 0.302$***

*p < 0.10 **p <0.05 ***p < 0.01

Hypothesis H_{3a}, that the cognitive instrumental variables of result demonstrability, information quality and personal relevance are positive determinants of usefulness was fully supported (Table 4). It should be noted that in further analysis of the composite model, personal relevance was both the most highly significant and largest predictor of change in the perception of usefulness.

However, the fourth hypothesis (H_{3b}), that of usefulness as a pre-determinant of perceptions of strategic importance presented the most interesting findings. In multiple regression modeling usefulness, ease of use and strategic importance, the relationship between usefulness and strategic importance was found to be highly significant (Table 5). However, further analysis of the relationship between usefulness, strategic importance and behavioral intention indicated a fully mediating effect of usefulness on strategic importance (Table 6).

Of equal interest (Table 7) was a corollary analysis of strategic importance added to the cognitive instrumental variables as determinants of usefulness. This model, with an R-squared of 0.767 was highly significant ($p < 0.0001$). Although all four determinants remained significant, result demonstrability ($p < 0.087$) and information quality ($p < 0.067$) were no longer significant at the alpha = 0.05 level. Strategic importance and personal relevance both continued as highly significant ($p < 0.0001$), indicating partial mediation of the effects of result demonstrability and information quality. Similarly, the beta coefficients for strategic importance and personal relevance demonstrated that they were stronger predictors of variation in usefulness.

Finally, although not formally tested as a hypothesis, two experimental treatments were given: one with web exercises directed towards gathering and analyzing

TABLE 4
RELATIONSHIP OF COGNITIVE INSTRUMENTAL VARIABLES WITH USEFULNESS

	Individual Variable Effects		**Composite Model Effects**	
	β	t	β	t
Result Demonstrability	.747	9.99***	.214	2.29**
Information Quality	.641	8.41***	.214	2.91***
Personal Relevance	.810	12.78***	.513	5.56***
				$R^2 = 0.716$***

*p < 0.10 **p < 0.05 ***p < 0.01

TABLE 5
RELATIONSHIP OF EASE OF USE AND USEFULNESS WITH STRATEGIC IMPORTANCE

	Composite Model Effects	
	β	t
Usefulness	.634	5.76***
Ease of Use	-.003	-0.03
		$R^2 = 0.506$***

*p < 0.10 **p < 0.05 ***p < 0.01

TABLE 6
RELATIONSHIP OF EASE OF USE AND USEFULNESS WITH STRATEGIC IMPORTANCE

	Composite Model Effects	
	β	t
Usefulness	.643	6.41***
Strategic Importance	.182	1.61
		$R^2 = 0.579$***

*$p < 0.10$ **$p < 0.05$ ***$p < 0.01$

TABLE 7
RELATIONSHIP OF COGNITIVE INSTRUMENTAL VARIABLES AND STRATEGIC IMPORTANCE WITH USEFULNESS

	Individual Variable Effects		Composite Model Effects	
	β	t	β	t
Strategic Importance	.801	9.43***	.333	4.27***
Result Demonstrability	.747	9.99***	.150	1.73*
Information Quality	.641	8.41***	.130	1.85*
Personal Relevance	.810	12.78***	.445	2.77***
				$R^2 = 0.767$***

*$p < 0.10$ **$p < 0.05$ ***$p < 0.01$

personal financial information; the other derived from the Laudon and Laudon text. The latter included exercises to check United Postal Service shipping rates and to determine hotel conference rates. An ANOVA of the two groups did not uncover any significant differences for the TAM, cognitive instrumental or strategic importance variables, but both heightened enjoyment and curiosity did indicate variation between the groups. In both cases, the group receiving the personal exercises experienced greater enjoyment and a higher level of curiosity than the group performing the business oriented tasks.

DISCUSSION

In retrospect, this study cast a wide net by examining predeterminants of both perceived ease of use as variables measuring cognitive absorption, and usefulness in the form of the cognitive instrumental variables in the same experiment. These predeterminants captured very different aspects of the application exercise. Again, it is important to note that the focus of the exercise was quite narrow—that of using web-based tools for gathering and analyzing financial information. Within this context, the cognitive absorption variables measured whether the web based hypermediation created an engaging mental environment for accomplishing the task. The usefulness component turned on the quality and relevance of the tools.

With regard to the relationship between cognitive absorption and ease of use, there was some support of Agarwal's original findings. Temporal disassociation and control were found to be significant determinants, as was curiosity, although in the opposing direction. Given that Agarwal's study examined general web use, and the experiment conducted in this assessment consisted of a controlled assignment, it is not surprising that heightened enjoyment and focused immersion would not play a significant role, as they might if the subjects were left to "surf the net" at will.

Of the three factors that were found to be significant, control emerged as having the greatest effect. Again, this is consistent with the nature of the exercise, as the ability to control (through the graphical interface and user-directed hyperlinks) the various web-based tools to complete the assignment should convey both a sense of mastery and corresponding ease of use. Temporal disassociation, while significant only at the $p < 0.10$ level, was also consistent with Agarwal's findings.

The negative results for curiosity were surprising; however, the findings may be explained by the nature of the questions posed by the measurement instrument. As with heightened enjoyment and focused immersion, the constructs captured by: "*I was stimulated....excited...my imagination was stimulated*" are more applicable to a situation in which the individual is roaming the web at will, rather than completing a business task. It should also be noted that because group differences were found for this variable, the composite model was assessed using multiple regression for each group. While both generated a negative coefficient, the group receiving the personal exercises was not significantly different from zero. Therefore, the significance of the negative findings was driven solely by the second group that received a standard set of business web-exercises based on the Laudon and Laudon text.

The importance of this study is found in the relationship between the cognitive instrumental variables, strategic importance, and usefulness. As hypothesized, the cognitive instrumental variables were found to be significant predeterminants of usefulness, replicating the findings of Venkatesh. The anticipation was that usefulness would be a predeterminant of the perception of strategic importance; and the initial findings did indicate a significant relationship between the two. Similar assessments of strategic importance and the intention to use also detected a significant relationship. But additional analysis of the model with intention to use included as a third variable, provided unexpected results. While usefulness remained a significant antecedent of intention to use, strategic importance was no longer significantly different from zero. Clearly, usefulness mediated the relationship between perception of strategic importance and intention to use.

With an improved understanding of the role of strategic importance as a predeterminant of usefulness; analysis of the composite model including the strategic importance presented interesting results. While each of the cognitive instrumental variables remained significant, the two strongest factors driving beliefs of system usefulness were (1) perceptions of personal relevance, and (2) strategic importance. The addition of strategic importance also increased the explanatory value of the composite model from an R-squared of 0.715 for the three instrumental variables in isolation, to an R-squared of 0.767 for the model encompassing both the instrumental variables and strategic importance. This appeared to indicate that there may be a dimension of usefulness that is impacted by considerations of relevance extending beyond a preoccupation with personal productivity.

CONCLUSION

Given that the study was largely a replication of prior research involving a different application of technology, the findings do provide mixed support for cognitive absorption as a predeterminant of ease of use, and strongly support Venkatesh's results of cognitive instrumental variables as antecedents of usefulness. There are, of course, limitations. Students are somewhat notorious as unreliable subjects. The instrument items, while maintaining internal validity, may have not been adequately adapted to the focus of the particular exercise.

Nevertheless, the findings regarding strategic importance as an antecedent of usefulness, and as a construct that is separate from personal relevance, is an important finding with interesting implications for practical applications. As businesses move towards distributed information technologies, such as enterprise resource planning systems, a strategic understanding of a system's usefulness could possibly mediate a reluctance to use a system—particularly if it appears that personal productivity may suffer. If this is the case, training interventions that emphasize the strategic importance of a particular technology could be developed to overcome personal reluctance, thereby improving user acceptance. A rigorous development of strategic importance as a component of user beliefs and intention to use, may enlarge our understanding of this process, perhaps increasing its effectiveness.

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APPENDIX A
MEASUREMENT SCALES

Cognitive Absorption

Temporal Dissociation

1. Time appeared to go by very quickly while I was working on the Web assignment.
2. I lost track of time while using the Web.
3. I found that the time flew by during the Web assignment.

Focused Immersion

1. While completing the Web assignment, I was able to block out most other distractions.
2. While completing the Web assignment, I was absorbed in what I was doing.
3. I was immersed in the task of completing the Web assignment.
4. While completing the Web assignment, I was not easily distracted by other attentions.
5. While on the Web, I found my attention was not easily diverted.

Heightened Enjoyment

1. I had fun interacting with the Web for this assignment.
2. Using the Web for this assignment provided me with a lot of enjoyment.
3. I enjoyed this Web assignment.

Control

1. When using the Web for this assignment, I felt in control of the material.
2. Using the Web for this assignment allowed me to control my computer interaction.

Curiosity

1. Using the Web for this assignment excited my curiosity.
2. My interaction with the Web during this assignment made me curious.
3. Using [illegible] Web to complete this assignment stimulated my imagination.

Information Quality

1. The quality of financial information I can gather and analyze on the Web is high.
2. I have no problem with the quality of financial information I can obtain and analyze on the Web.

Result Demonstrability

1. I have no difficulty telling others about the results of using the Web to gather and analyze financial information.
2. I believe I could communicate to others the advantages/disadvantages of using the Web to gather and analyze financial information.
3. The advantages and disadvantages of using the Web to gather and analyze financial information are apparent to me.
4. I would have no difficulty explaining why using the Web to gather and analyze financial information may or may not be beneficial.

Personal Relevance

1. Using the Web to gather and analyze financial information gives me an important personal advantage.
2. Using the Web to gather and analyze financial information is relevant to my personal financial decisions.
3. I believe the information I obtain and analyze through the Web is helpful in making personal financial decisions.

Perceived Ease of Use

1. I find the Web easy to use as a tool to gather and analyze financial information.
2. Interacting with the Web to gather and analyze financial information does not require a lot of my mental effort.
3. I find it easy to get the financial information I want using the Web.
4. My interaction with the Web as a tool to gather financial information is clear and understandable.

Perceived Usefulness

1. Using the Web improves my ability to gather and analyze financial information.
2. Using the Web to gather and analyze financial information enhances my effectiveness in making decisions.
3. I find the Web to be useful to me in gathering and analyzing financial information.
4. Using the Web-based increases my productivity in gathering and analyzing financial information.

Behavioral Intent

1. Assuming access to the Web, I intend to use it for gathering and analyzing financial information.
2. Given access to the Web, I predict that I will use it to gather information for making financial decisions.
3. I believe that I will continue to use the Web for information when faced with financial decisions.

Strategic Importance

1. I understand that using the Web to gather and analyze financial information could give businesses an important strategic advantage.
2. I understand that using the Web to gather and analyze financial information could be relevant to making important business decisions.
3. I understand that the Web can provide important tools that could help businesses gather and analyze information to their strategic benefit.

A HIERARCHY OF NEEDS FOR A VIRTUAL CLASS

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ABSTRACT

Distance Learning (DL) initiatives are proceeding full speed ahead, both within traditional universities and in "virtual" institutions specializing in on-line course delivery. Much has been written about the virtues and limitations, the obstacles and enablers, and the "Do's" and "Don'ts" of DL. However, considerable work remains in determining actual learning outcomes of the various approaches to DL. This paper describes a useful framework for designing and evaluating DL course delivery that is based on Maslow's Hierarchy of Needs model applied to virtual learning communities. The results of analyzing preliminary outcomes from a set of virtual courses in Introduction to Information Systems provide some initial support of the framework.

INTRODUCTION

A number of factors have contributed to the growth and the phenomenon of Distance Learning (DL). University administrators are under continued pressure to increase enrollments, to decrease costs by serving more students with fewer faculty and university resources, and to make education more accessible to a wider range of learners, both geographically and demographically. Technological advances in software tools, data communication networks, and multiple media, most dramatically demonstrated in the exponential growth of the World Wide Web, have provided the infrastructure for making it possible to achieve these goals. Continued increases in existing and immigrant populations, strong economic growth in many regions, and a growing awareness of the economic benefits of a college education, have all combined to increase demand for post-secondary education from a widening diversity of demographic sources (Dede 1990).

The result is that DL initiatives are proceeding full speed ahead, both within traditional universities and in "virtual" institutions specializing in on-line course delivery. Much has been written about the virtues and limitations, the obstacles and enablers, and the "Do's" and "Don'ts" of DL. However, considerable work remains in determining actual learning outcomes of the various approaches to DL. This paper describes some relevant background and the subsequent evolution of a useful framework for designing and evaluating DL course delivery. The results of analyzing preliminary outcomes from a set of virtual courses in *Introduction to Information Systems* provide some initial support of the framework.

BACKGROUND

What is the definition of "Distance Learning?" DL means different things to different people. Its definition has evolved as computer and communications technologies have become more sophisticated, more powerful, less costly, and more widespread. For the purpose of this paper, DL is defined as course delivery over networks to multiple geographic locations using flexible access methods. The term DL is used synonymously with the term on-line learning, and also refers to what is sometimes called asynchronous learning, although DL can be both synchronous as well as asynchronous depending upon the tools used.

Distance Learning and Education Theory

The current state of DL represents the convergence of technical and social educational evolution. Pre-computer correspondence courses are often cited as the earliest examples of DL (Dunning 1990). However, the most traditional type of DL is that of the one-way video transmission of a lecture format to one or more classes of remotely located respondents. Advances in technology have facilitated changes in the perception and definition of DL from a passive 1-way video lecture model to an interactive student-instructor and student-student model employing a variety of communication media as needed (Bates 1991).

Education theories based on Vygotsky (Vygotsky 1978) and others have served as the foundation for the concept that effective learning must be active, cooperative, student-centered, and socially constructed (Damon 1984); (Topping 1992); (Webb 1982). A body of research known as computer-supported cooperative learning (CSCL) initially focused on the application of information technologies to individual students and small groups in a traditional classroom context (Koschmann 1996). This research stream offers insight into the now extensive use of the WWW and accompanying Internet tools to deliver interactive DL. At the same time, studies of computer-mediated communication (CMC) provide useful information about the effective use of various electronic media now used in delivering interactive instruction (Berge and Collins 1995).

Learning Communities

As the focus of computer-support for learning has evolved from individual interaction with a computer toward technology support for interaction among dispersed members of the group, an additional development in educational research and practice has become increasingly relevant: the learning community.

A learning community encompasses the idea that learners benefit more if they actively contribute to their own and others' learning. The members have a socially constructed, shared view of their goals and processes, and a sense of identity and belonging to the community. A virtual community is a real community but whose members interact electronically as well as, or, for some or all members, in place of physical interaction. A virtual learning community incorporates both the primary goal of learning and the notion that at least some members of the community do not interact face-to-face (FTF) and thus require various technologies to communicate (Hiltz 1994).

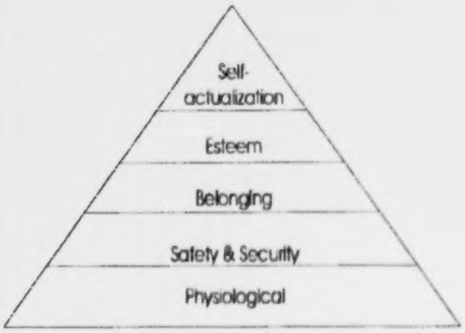
Although some DL research has focused on the pros and cons of particular CMC tools (e-mail, bulletin boards, chat), others have taken a more holistic view, demonstrating that a DL class can indeed result in an effective learning community (Powers and Mitchell 1997); (Haythornthwaite, Kazmer et al. 2000). An effective DL environment provides a flexible toolset that allows the instructor to adapt the appropriate tools to various pedagogical methods and to create a learner-centered environment by identifying what knowledge and skills the student brings to the course and configures the environment to meet her there (Bransford, Brown et al. 2000). It also allows the students to select tools that match the various types and levels of interaction (public/private, informal/formal, spontaneous/reflective) needed in developing a virtual learning community (VLC), as well as the tools that can best exploit the skills and knowledge they bring to the class.

The purpose of this research is to address the following question: *How can our understanding of virtual learning communities help us to design, and to evaluate the effectiveness of, DL experiences that support pedagogical goals and contribute to student learning outcomes?*

RESEARCH FRAMEWORK

Maslow (1970) developed a Hierarchy of Needs, which describes five layers of needs that humans experience: physiological needs, safety needs, the need for love and belonging, esteem needs, and the need for self-actualization (Figure 1). Lower level needs must be fairly well met before an individual experiences higher level needs.

FIGURE 1
MASLOW'S HIERARCHY OF NEEDS



According to the theory, the first four levels represent deficit needs: an individual feels the need if he does not have enough. After a need is met, it is no longer felt. After one's needs are more or less met on one level, a person feels the needs on the next level. For example, if an individual has no food or water and no friends, he will first try to get enough food and water before seeking friends. Self-actualization, or growth motivation, is not a deficit need; rather, it is continually felt. Once experienced, the need to fulfill one's potential to the fullest does not stop. All deficit needs must be fairly well met before a person can be self-actualizing. Self-actualized people are independent, yet have intimate personal relationships with a few people. They are compassionate and creative, and accept themselves and others for what they are. Few people are self-actualizing (Maslow 1970).

This Hierarchy of Needs can be applied to community building on the World Wide Web (Kim 2000). Table 1 summarizes this concept. Members of a virtual community go through a similar set of levels of need in order to become active, contributing members of the virtual community. A participant must first be able to gain access to the community, through technology and training (knowing how to access it). Once able to take this for granted, an individual experiences the need to feel safe from unwanted or unexpected negative interactions from other community members. The next level is where she will successfully interact with other community members and develop a sense of identity with the community. Once this need is met, she is able to move on to making positive, acknowledged contributions to the community. The highest level, which is likely to be achieved only by a small proportion of community members, involves taking on recognized community roles and helping to shape the continuing evolution of the community, which in turn helps the individual develop.

TABLE 1
ONLINE HIERARCHY OF NEEDS[1]

Level of Need	Maslow's Definition	Corresponding Online Learning Need
Physiological	Oxygen, water, food, clothing, shelter, health	System and Internet access
Safety	Safe circumstances, security, protection, stability, structure, order	Protections from personal attacks and hackers. Structure, order, consistency
Belonging	Ability to give and receive love; need to be a member	Belonging to a community (the class as a whole) and to subgroups (e.g., teams)
Esteem	Status, recognition, attention, self-respect, confidence, competence, achievement	The ability to contribute to the course/community and be respected for it. Competence and achievement.
Self-actualization	Ability to fulfill one's potential	The ability to take a role in the course/community that develops and challenges one's self.

[1] Adapted from Kim, "Building a Successful Community" (p. 9).

How can educators apply this model toward building virtual learning communities in distance learning classes? Students who are having trouble accessing the systems, either due to technical problems or lack of training, cannot be expected to move on to higher levels of participation until these issues have been resolved. Likewise, if students do not feel safe from attacks or criticisms when making contributions, they will not be able to become contributing members of discussions or sub-groups (teams). Finally, students who do not feel a sense of belonging to the community or sub-group are less likely to contribute, and thus likely to get less from the course.

The on-line hierarchy describes how students can move from being individual learners to becoming active members of a learning community, through knowledge and assessment. Because students entering a course may come from a variety of backgrounds and perspectives, DL instructors should at least initially emphasize a learner-centered approach. Ongoing assessment will provide feedback to the instructor and students about their need levels in the on-line hierarchy, as well as in their knowledge in the course domain. Students who have unmet needs at lower levels are likely to perform more poorly until those needs are met and they can move on to become more active, participating members of the learning community.

RESEARCH METHODS

In order to gain some initial support for the framework described above, data were collected from two distance learning sections of an undergraduate Introductory Information Systems class. There were 52 students enrolled in the two sections, 28 in one section and 24 in the other. Text, on-line notes, assignments, projects, grading criteria, and exams were identical in both sections. Each student completed five individual homework assignments, including three "hands-on" assignments (constructing a spreadsheet, database, and a web store) and two written exercises (on expert systems and networks). Each class had its own WebBoard where questions were posted and discussed by the class as a whole. Participation in these discussions was required.

Students in each class were randomly assigned to a team at the start of the course and virtually no one knew their teammates before the class. Each team was given a private discussion area on the WebBoard, which they could use for communication. However, no restrictions were placed on communication methods—teams could meet face-to-face if they wished. Two team projects were required. There was a short hardware configuration assignment due within the first few weeks of the course, designed to help teams get used to working together. The second project involved researching a topic, and then designing and constructing a web site to educate the class about the topic.

Although WebCT was the primary online tool used in both sections, technological limitations prevented all its features from being used. Students took online quizzes covering each chapter in WebCT and had the option to first take practice quizzes. Narrative lecture notes were available online for each chapter, explaining material that the instructor would have covered in a lecture. Due to the technological difficulties, the asynchronous conferencing facility, e-mail, and chat features of WebCT were not used. Instead, the classes used external e-mail, and O'Reilly & Associates, Inc. WebBoard for web conferencing (primarily through asynchronous postings, although the realtime chat feature was available for student teams to use).

RESULTS

Several items were included on the course evaluation administered at the end of the semester to determine student perceptions of the various online tools used in the course (Table 2). Each item was answered on a scale of "1" (Poor) to "5" (Excellent). Thirteen students answered the questions.

As can be seen in Table 2, students believed that the on-line quizzes (both practice quizzes and graded quizzes) contributed most to their learning, followed closely by individual assignments (i.e. homework). Both WebBoard discussions and team projects were considered less than "good" in helping students learn. The nonparametric Mann-Whitney test was used to identify differences in response between the two sections; no significant difference was found (significance for all tools except WebBoard was greater than 0.80; WebBoard was $p = 0.29$), indicating responses were not affected by the class or instructor.

As shown in Table 2, the more familiar and structured tools were preferred. That is, practice quizzes, homework, and lecture notes, familiar tools to students, were preferred over the less structured and less familiar Webboard discussions and collaborating with a team, largely by electronic means.

TABLE 2
COURSE EVALUATION RESULTS

Item	Mean*	S.D.
How helpful were the WebCT On-Line Quizzes in helping you learn the course material?	3.93	0.83
How helpful were the individual assignments in helping you learn the course material?	3.71	0.85
How helpful were the WebCT Notes in helping you learn the course material?	3.29	0.99
How helpful were the WebBoard Discussions/Conferences in helping you learn the course material?	2.94	1.29
How helpful were the Team Projects in helping you learn the course material?	2.88	1.20

Students were also asked how their team communicated while working on assignments, reporting the proportion of communications taking place face-to-face, via phone, using e-mail, on the WebBoard, or using online chat. An additional analysis was performed which linked team project outcomes (grades) to the their usage of these CMC tools. Although teams could use any means to communicate (in fact, there were scheduled optional opportunities to allow them to meet on campus), all but one team chose e-mail or the WebBoard for most of their communication. In general, teams who relied almost completely on e-mail to communicate received lower grades than did those who supplemented e-mail with asynchronous web conferencing and other media.

DISCUSSION

How do these results contribute to our understanding of designing virtual courses and learning communities? In the context of the hierarchy, it makes sense that some students preferred the more structured and familiar tools, and were hesitant about WebBoard participation and virtual teamwork. This was the first distance learning class for almost half of the students. Most of the remaining students had taken only one previous distance class; a few had taken more. Thus, some of the students were still trying to understand the technology and make it work; others were seeking order and possibly feared personal attacks.

Since most people have not reached Maslow's self-actualizing level, educators must understand that most students are struggling to meet deficit needs (physiological, belonging, esteem). Instructors need to provide them with tools and pedagogy to help them meet these needs. This meshes well with current learning theory that learner-centered environments are optimal. Learner-centered environments diagnose where the student is and start from that point (Bransford, Brown et al. 2000). In short, students cannot be expected to engage in lively real-time debates when they cannot maintain a constant connection to their ISP. Many of the students in these two sections were still trying to figure out how a distance class works, as well as simply how to get on-line consistently. Therefore, it is not unexpected that they preferred the most structured and familiar tools: quizzes and notes.

The results from the team project analysis suggest that students who relied primarily on e-mail communication may have been lower in the hierarchy of needs and this resulted in lower performance overall. A tentative conclusion might be that those students who performed better had moved to higher levels and were able to make more effective and appropriate use of the variety of tools available.

CONCLUSIONS AND FUTURE RESEARCH

Clearly, the data discussed here was collected from *post-hoc* personal reports from a very limited sample and can only be used to suggest directions for further research. The sample consisted of general business students taking a required Information Systems course. However, the model offers much potential in guiding our design and evaluation of DL courses. DL courses need to determine and address the unmet lower level needs of incoming students (many institutions now offer self-assessments which contribute to this). In addition, students and instructors need flexible toolkits that offer them a graduated progression from more comfortable to more challenging tools. Finally, the virtual learning community approach, enriched by the on-line hierarchy of needs and with a learner-centered emphasis, provides a rich context for design and assessment of DL.

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DEVELOPMENT OF AN E-COMMERCE MODEL CURRICULUM

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Extended Abstract

Electronic markets are becoming increasingly popular and are providing companies with another avenue in which to compete for revenue. The rise in popularity of the Internet combined with the increasing processing capabilities of computers and increasing computer literacy of users has added fuel to the e-commerce fire. New startups and traditional brick and mortars are using e-commerce to increase transaction effectiveness and efficiency (Lee and Clark, 1996-1997) and enter new markets. Due to the increasing usage of the Internet and e-commerce, student demand for e-commerce courses has increased dramatically at universities as seen by the increase in number of courses offered. Similar to the O'Hara and Stephens (1999) research on a required IT course, this study "should be a useful bench marking tool for those teaching such courses, for those responsible for IT curriculums, and for those involved in AACSB accreditation or reaccreditation." In an attempt to assist e-commerce course designers in selecting content and methodologies, this article will summarize the analysis of the e-commerce courses offered at top MBA programs across the United States.

Schneberger, et al. (2000) and Surendra (2000), among others, have attempted to outline e-commerce curricula. Although these professors have compiled some pertinent materials, the basis for their curricula has been largely based upon peer discussions and personal opinion. In many instances this may be a valuable means of designing a course, but it is the authors' opinion that an evaluation of e-commerce courses taught at top MBA programs would provide a better method of collecting topics, methodologies, and ideas related to a course.

The sample consists of schools that are listed in Business Week's ranking of top business schools. The top thirty schools were chosen and an initial search of the School web pages was performed. In cases where the course syllabus could not be found, the Dean's office was contacted with a request for the name of the professor teaching the introductory level e-commerce course at the MBA level. A fax was sent to that professor requesting a copy of the syllabus. Syllabi from eighteen of the thirty universities were received.

General domains of knowledge were chosen from the sample. Each course was analyzed with the purpose of dividing all content into the domains previously determined. After the initial domain classification, a second analysis was performed to determine any sub-domains in existence. Based upon the preliminary research perfomed, domains include:

- Business models
- Strategy
- Infrastructure

- Technology
- Programming languages
- Privacy and security
- Payment
- Advertising
- Pricing
- Auctions
- Legal issues

Earlier work by Sendall (1999) found 18 academic domains, many of which were similar to those found in this study.

After completing the classification of all content covered in the e-commerce courses, an outline will be developed that will provide other programs with the framework around which to build an e-commerce course. As universities expand their course offerings to include e-commerce, they can learn from other universities that already have courses in existence (O'Hara, 2000). This study will hopefully lead to a standard model that can be used and is based upon the content covered in some of the best schools in the world.

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ALIGNING E-BUSINESS PROGRAMS WITH INDUSTRY NEEDS

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ABSTRACT

The paper describes a research that investigates the alignment between e-business academic programs and skill sets that are sought after in e-business related job postings. A fit-gap analysis will be performed. The fit-gap analysis will identify skill sets that require greater or less emphasis in e-business academic programs. The findings of this research will also help us to rethink and restructure the e-business programs to meet new challenges.

INTRODUCTION

The Internet has indeed transformed the world. E-Business has impacted almost every segment of the world economy. The plethora of opportunities opened in this cyber-frontier has taken the spirit of entrepreneurship to dizzy heights in the last decade. The Achilles' heel in this new economy is the lack of IT professionals with the right skill sets—constant complaint from recruiters. This study investigates the alignment of e-business academic programs with the e-business job market.

LITERATURE REVIEW

E-business is defined as the conduct of business with the assistance of telecommunications and telecommunication-based tools (Clarke 1999). This definition covers a broad range of activities, including business-to-business (B2B), to business-to-customer (B2C), to intra-organizational commerce (Siau & Davis, 2001). The e-business "big-bang" caught most of the academic institutions by surprise. Not surprisingly, most schools were not able to follow suit with the requisite programs or courses. A discernible upsurge in e-business programs to overcome this lag is clearly evident, especially in the top US business schools. However, the nature of the response varies considerably among schools. Some schools have rejected outright the need for a separate e-business program, whereas other schools have embraced and staked their reputation on their new e-business programs. Are these programs producing the right kind of graduates for the industry? What are the core and optional courses in e-business programs?

RESEARCH METHODOLOGY

This study analyzes the e-business programs in the top business schools ranked by the *US News* and *Business Week*. We document the length and breadth of the various types of e-business programs offered by the top business schools through content analysis of their e-business program websites. In addition, we investigate the skill sets sought after by employers through content analysis of job placement websites. We will attempt to map the skills required by the employers for different jobs to the courses offered in e-business programs. This fit-gap analysis will shed light on the core and optional courses in e-business programs and the skill sets needed by IT professionals in this e-business era.

Data Collection

The first task in this study is to analyze the business schools in the US to understand the length and breadth of the various types of e-business programs/courses they offer. Rather than doing an exhaustive search of all the e-business programs in business schools, which is impossible, we decided to look at the e-business programs in top US business schools. The top thirty business schools, ranked independently by *US News* and *Business Week* (see Appendix A), were selected as our sample. Since the two lists do not overlap completely, we have a total of 42 schools in our sample. The *US News'* ranking is for the top undergraduate business programs and the *Business Week*'s ranking is for the top MBA programs. This sample, in our judgment, is representative of the past trends and the future projections in the e-business educational arena. These are the top business schools in the nation and they set the standard for education. It should be noted that the two lists provide us a mean to select our sample; but when performing data collection we look for undergraduate, graduate, and certification e-business programs in each school—irrespective of the list the school is in.

The second aspect of our study will be to assess industry demand for e-business professionals and the skill sets needed for specific e-business career tracks. To perform this analysis, we will conduct an extensive content analysis of e-business job listings on major US Web job sites (e.g., Dice.com, Monster.com, and BrassRing.com). Specifically, the content analysis will focus on two outcomes: i) identifying general categories of e-business professions (e.g., Web site developer, Java programmer, data base specialist), as well as the relative percentage of positions within each profession; and ii) the specific job skills required for each position type.

ANALYSIS AND PRELIMINARY RESULTS

We have finished analyzing the websites of e-business programs offered by top business schools. The content analysis of major US Web jobsites is still ongoing.

Types of E-Business Programs

The content analysis of the top business schools' websites reveals six types of e-business programs (as shown in Appendix B). Most of the existing programs are at the graduate level. Some programs are more focused (major or concentration) whilst others are subcategories of existing programs (e.g., minor). We also observed that some schools are beginning to offer certification programs in e-business. These are typically shorter programs and the aim is to train existing IT professionals in e-business. The duration of the MBA programs varied from 1-2 years, while the certification programs are less than one year.

Based on the content analysis, we came up with Appendix C that categorizes the courses offered in these e-business programs. A detailed analysis of the courses offered by these schools showed that there are two broad and distinct tracks in the MBA programs. One track paves the path for an e-business career with a predominant focus towards the business aspect, whereas the other track leads to a career emphasizing technology and web-based systems development.

Business track. Within the superset of e-business, this track consists of core courses in Law, Marketing, Finance/Accounting, and Infrastructure and Technology for the Internet. The electives are geared towards shaping a career for the students in the areas of E-Business Analyst, E-Merchandising Consultant, E-Business Financial Analyst, Cross-Functional Enterprise Architect, and E-Commerce Entrepreneur. Also, a practicum is usually included to expose students to the industry.

Technology track. This track typically starts with prerequisites/core courses in basic programming (e.g., C++/Java), E-Business Systems Analysis and Design, Database Systems Design and Implementation, and Web Development. The specializations are geared towards entering into technical positions in industry such as Web Developer, Technical Consultant, Systems Integration Specialist, Web-based ERP Analyst, Wireless Telecommunications Analyst, XML Developer, E-business Infrastructure and Technical Architect, and E-Solutions Entrepreneur.

Initial Observations on the Fit-Gap

Preliminary results of our fit-gap analysis provide several interesting findings: i) There is a growing demand in industry for ERP-Web integration. However, few, if any academic programs have addressed this particular issue; ii) Only one or two programs have focused on vertical industry specializations (e.g., financial services, health care) in the e-business curriculum; iii) Also, even though mobile commerce is growing in importance (Siau *et al.* 2001), few e-business programs address the issue of managing e-business for mobile users. Potential issues here include: development of mobile EB interfaces, creating and implementing new technologies for mobile computing, and security and reliability of mobile EB applications; iv) Managing e-business in an increasingly global environment is also noteworthy. Issues here focus on managing cross-border commerce: delivery of products and services, international monetary issues, governmental regulations, and consumer cultural differences; and v) Few academic programs offer courses in e-business architecture, even though many positions rely heavily on knowledge of how to set up and maintain the physical and application infrastructure for an e-business.

CONCLUSION

Our content analysis of e-business academic programs and e-business job advertisements will allow us to perform a fit-gap analysis by comparing skill sets demanded in business with skills taught in the major e-business programs. This study will permit us to begin to identify areas that require greater or less emphasis as market demands continue to evolve. By identifying these and other potential issues, we hope to begin to provide useful suggestions with regard to rethinking and restructuring e-business programs and, perhaps, helping them become more relevant to current business needs.

This study is ongoing and will be completed by November. Full research findings will be available for IAIM'2001 presentation.

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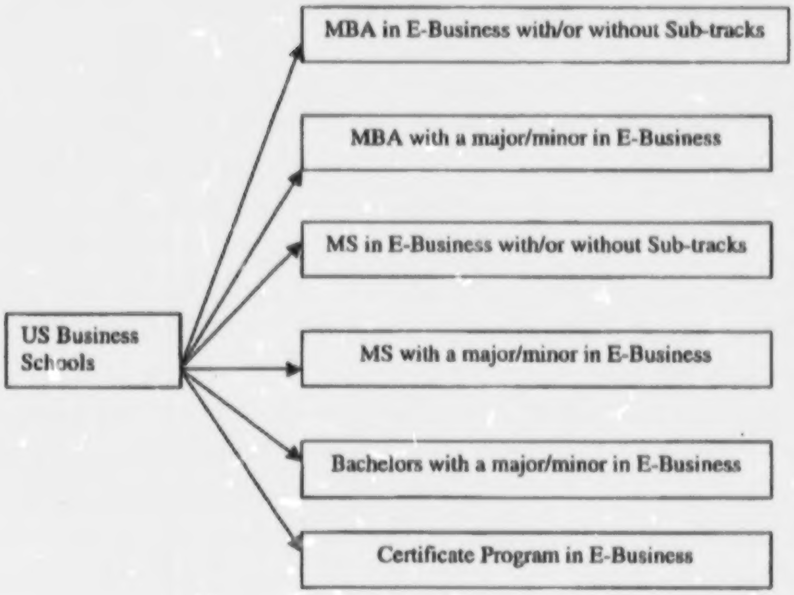
APPENDIX A
US BUSINESS SCHOOL RANKINGS

Rank	*US News*	*Business Week*
1	University of Pennsylvania	University of Pennsylvania (Wharton)
2	Massachusetts Institute of Technology University of Michigan-Ann Arbor	Northwestern (Kellogg)
3		Harvard
4	University of California-Berkeley	MIT (Sloan)
5	Carnegie Mellon University University of North Carolina-Chapel Hill University of Texas-Austin	Duke (Fuqua)
6		Michigan
7		Columbia
8	New York University University of Virginia	Cornell (Johnson)
9		Virginia (Darden)
10	Indiana University-Bloomington University of Illinois-Urbana Champaign University of Wisconsin-Madison	Chicago
11		Stanford
12		UCLA (Andersen)
13	Purdue University-Lafayette University of Minnesota-Twin Cities University of Southern California	NYU (Stern)
14		Carnegie Mellon
15		UNC-Chapel Hill
16	Emory University Ohio State University-Columbus Washington University in St. Louis	Dartmouth (Tick)
17		Texas-Austin (McCombs)
18		UC Berkeley (Haas)
19	Michigan State University Pennsylvania State University-University Park	Yale
20		Indiana
21	Babson College Case Western Reserve University University of Arizona University of Florida University of Maryland-College Park University of Notre Dame University of Washington	Rochester (Simon)
22		Vanderbilt (Owen)
23		Washington University (Olin)
24		USC (Marshall)
25		Purdue (Krannert)
26		Georgetown (McDonough)
27		Maryland (Smith)
28	Arizona State University Georgetown University Texas A&M University-College Station University of Georgia University of Iowa Wake Forest University	Emory (Goizueta)
29		Michigan State (Broad)
30		Georgia Tech (DuPree)

(Source: *US News* Undergraduate Business Program Ranking 2001 & *Business Week's* MBA Ranking 2001)

APPENDIX B
TYPES OF E-BUSINESS PROGRAMS


US Business Schools
MBA in E-Business with/or without Sub-tracks
MBA with a major/minor in E-Business
MS in E-Business with/or without Sub-tracks
MS with a major/minor in E-Business
Bachelors with a major/minor in E-Business
Certificate Program in E-Business

APPENDIX C
CATEGORIES OF E-BUSINESS COURSES OFFERED IN BUSINESS SCHOOLS

Introduction to E-Business
- Electronic commerce
- Infrastructure for e-business
- Digital economy and commerce
- Electronic commerce and virtual organizations

E-Business Management
- Project management
- Management of technology and EC projects
- Service process management
- Managing the digital business
- Management of small business systems
- Managing information in the competitive environment

E-Business Technology
- Technology for electronic commerce
- Operations infrastructure for the e-corporation
- Emerging technologies
- Networking technology
- Advanced information technology
- Business models and technology

E-Business Strategy
- Industry structure and competitive strategy
- Managing inter-firm strategic alliances
- Telecommunications technology and competitive strategy
- Corporate strategies and practices in services industries
- Financial strategy
- Strategic issues in electronic commerce
- Strategic management of technology and innovation
- Strategic analysis for high tech industries

E-Business Marketing
- Entrepreneurial marketing
- Electronic commerce and marketing
- Marketing high tech products
- Electronic channels
- Consumer marketing
- Advertising management
- Customer experience design for E-business
- Marketing research
- New product development
- Marketing decision support

Java and Object-Oriented Programming

- Object-oriented and visual paradigms
- Core java for electronic commerce
- Programming in C and Java

E-Business Economics and Markets

- Managerial economics and game theory
- Technology in global markets
- Economics for managing information in electronic commerce
- Economics for innovation and entrepreneurship
- Markets and netcentric systems
- Impact of the Internet on mature industries

E-Business Systems Development

- Development of e-business applications
- Information retrieval system design
- EC implementation
- Development technology for the Web

Operations and Supply Chain Management

- Supply chain management
- Operations and marketing integration
- Manufacturing and Quality
- Operations strategy and project management

Legal and Regulatory Issues in E-Business

- Legal, audit, and tax issues for e-business
- Electronic commerce law and regulation

Data Management

- Data base management
- Data mining techniques for business
- Applied Data Analysis
- Data management and decision support systems
- Knowledge management

Global E-Business Management

- Technology in global markets
- Global information systems
- Global information technology management

Business Process Reengineering in E-Business

- Strategic business transformation
- Managing organizational change
- Managing information-intensive change
- Leadership and change in organizations
- Business process reengineering through information technology

Data Communications

- Communications technology and policy
- Computer mediated communication and electronic commerce
- Competition in telecommunications
- Wireless network & mobility
- Distributed component architecture
- Business data communications

E-Business Security

- Computer security
- Risk and controls in electronic commerce
- Web commerce security

Entrepreneurship in E-Business

- Innovation, change, and entrepreneurship
- High tech entrepreneurship
- Entrepreneurial marketing
- New venture creation
- Entrepreneurial finance

Business Models in E-Business

- Marketing models
- Enterprise integration models
- Internet business models and technology

Electronic Payment Systems

- Electronic payment systems

Interface Design

- Human factors in IS
- User interface design for the Web
- Advanced computer graphics
- Multimedia systems

Enterprise Resource Planning

- Enterprise resource planning

E-Business Practicum

- Entrepreneurial laboratory
- E-Commerce Project

Computer Ethics

- Computers, ethics, and society

Intelligent Systems

- Intelligent systems

INFORMATION SYSTEMS ACCREDITATION

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ABSTRACT

While this proposal gives a background for the development of the Criteria for Accreditation of Information Systems Programs, the panel will concentrate on the Criteria, preparing for an accreditation visit, and new developments in IS accreditation.

Program accreditation has been a very effective mechanism for assisting in quality assurance in programs in many disciplines, particularly at the baccalaureate level. Computer Science programs have been accredited by the Computing Sciences Accreditation Board (CSAB) beginning in 1986. Now over 160 computer science programs are accredited and more programs seek accreditation each year [1]. Since its inception, CSAB has been interested in expanding program accreditation beyond Computer Science. With funding from a grant from the National Science Foundation (NSF), Criteria have been developed for accreditation of programs in Information Systems. These Criteria were approved CSAB in July 2000 and pilot accreditation visits were approved for the Fall of 2001, thereby allowing the possibility of accreditation of IS programs to begin in July 2002.

INTRODUCTION

With the rather recent developments in IS curricula, a good basis for the establishment of IS criteria for accreditation became available. The recent major activities in the development and dissemination of Curricula [Information Systems '97 (IS'97), Information Systems Centric Curriculum '99 (ISCC'99) [2] and the substantial effort on IS 2000] and the adoption or adaptation of these curricula are major contributions to the curricular portion of the accreditation criteria.

Using the basic form and format developed by the Computer Science Accreditation Commission for accrediting Computer Science programs (www.csab.org) as a pattern, the Criteria for Accreditation of Information Systems Programs were developed. The significant curriculum documents referenced above provided a basis for the Curriculum portion of the Criteria. The Draft Information Systems Accreditation Criteria were discussed at many conferences, including ACM SIGCSE, FIE, AIS, ISECON, IAIM and ICIS. Comments from these conference presentations were considered and the Draft Criteria were revised. The curriculum area seemed to be the area of greatest interest and a web survey was conducted allow public review of the curriculum. Over 300 people responded to the web survey. The survey was analyzed and the Draft Criteria were revised to become the proposed "Criteria for Accreditation of Information Systems Programs."

WHAT CONSTITUTES AN ACCREDITED PROGRAM

An accredited program is one that has been reviewed by qualified and trained visitors and meets the Criteria established and approved by the CSAB. Only programs that are in institutions that have regional accreditation can be considered. This means that the evaluators visiting the institution are assured that the institution has in place the necessary infrastructure to offer programs leading to the degrees they offer, particularly on the undergraduate (baccalaureate) level. Accreditation is voluntary and an institution wishing to be accredited must request an accreditation evaluation.

WHO BENEFITS FROM ACCREDITATION

Many groups benefit from accreditation, including students, parents, employers, the public, the institution, department and the program. Students benefit, by being assured that they are being taught what they need to know to prepare them to function as a professional in the information systems field. They can choose to attend a university that has shown that it provides the type of education deemed necessary by CSAB and the professional societies that have developed the Criteria: Association of Computing Machinery (ACM), Association for Information Systems (AIS), Association of Information Technology Professionals (AITP), and the IEEE-Computer Society (IEEE-CS). Parents have increased assurance that they are paying for an education that will adequately prepare their son or daughter to enter the workforce or go on for graduate education in the field.

Employers value accreditation because students graduating from an accredited program have attained a certain level of competence. This provides the employer with a workforce that has acquired a certain level of ability in the field. CSAB encourages their employees to participate in the accreditation process, specifically by commenting on the Criteria, proposing and commenting on changes to the Criteria, and serving as Program Evaluators and Team Chairs for site visits to evaluate programs.

The public has a stake in accreditation, because as business, industry, government and individuals rely more and more on computers and the software that runs them, it is vital that minimum standards of preparation of workers be set in place. It is necessary that the systems upon which the public relies be designed, developed and maintained by competent professionals. Accreditation is one way to assure, at least minimum preparation, of people entering the field. As more and more computer systems can impact the life, health and safety of people everywhere, having competent information systems personnel is essential.

Accreditation benefits the institution, the department and the program being accredited. The self-study is in and of itself of benefit to the program. The reputation of the institution is enhanced when the program is recognized as having met the standards of accreditation. The department benefits by having an accredited program when it recruits students and as it works to hire and retain faculty. Program accreditation assists in quality assurance.

EXCERPTS FROM THE CRITERIA FOR ACCREDITING INFORMATION SYSTEMS PROGRAMS

The criteria are divided into seven major categories. Each program must meet every intent.

> An *Intent* provides the underlying principles associated with a category. For a program to be accreditable it must meet the Intent statement of every category.

Objectives and Assessments

Intent. The program has documented educational objectives that are consistent with the mission of the institution. The program has in place processes to regularly assess its progress against its objectives and uses the results of the assessments to identify program improvements and to modify the program's objectives.

Students

Intent. Students can complete the program in a reasonable amount of time. Students have ample opportunity to interact with their instructors and are offered timely guidance and advice about the program's requirements and their career alternatives. Students who graduate the program meet all program requirements.

Faculty

Intent. Faculty members are current and active in the discipline and have the necessary technical breadth and depth to support a modern information systems program.

Curriculum

Intent. The curriculum combines professional requirements with general education requirements and electives to prepare students for a professional career in the information systems field, for further study in information systems, and for functioning in modern society. The professional requirements include coverage of basic and advanced topics in information systems as well as an emphasis on a supportive area. Curricula are consistent with widely recognized models and standards.

Technology Infrastructure

Intent. Computer resources are available, accessible, and adequately supported to enable students to complete their course work and to support faculty teaching needs and scholarly activity.

Institutional Support and Financial Resources

Intent. The institution's support for the program and the financial resources available to the program are sufficient to provide an environment in which the program can achieve its objectives. Support and resources are sufficient to provide assurance that an accredited program will retain its strength throughout the period of accreditation.

Program Delivery

Intent. There are enough faculty members to cover the curriculum reasonably and to allow an appropriate mix of teaching and scholarly activity.

Institutional Facilities

Intent. Institutional facilities including the library, other electronic information retrieval systems, computer networks, classrooms, and offices are adequate to support the objectives of the program.

CONCLUSION

With the recently developed, disseminated and adopted curricula in IS, the desire of CSAB to look beyond the accreditation of Computer Science and to consider accreditation of Information Systems programs, and funding from the National Science Foundation, everything seems to be coming together to make accreditation of Information Systems Programs a reality. The proposed "Criteria for Accreditation of Information Systems Programs" has been approved by CSAB and pilot visits are underway. It is anticipated that many programs will apply for IS accreditation in the near future.

ACKNOWLEDGEMENT

This project was funded by the National Science Foundation grant NSF DUE 9812278.

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[2] www.iscc.unomaha.edu.

A STRATEGY TO OVERCOME CHALLENGES IN TEACHING AN INTRODUCTORY MIS COURSE

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ABSTRACT

The challenges of teaching an introductory MIS course have changed over the last decade. In this action research project, a three phase approach was taken. Firstly, the problem was diagnosed and a strategy formulated. Secondly, action was taken to implement the strategy over one semester; and thirdly, in the reflective learning phase, the outcomes were determined and the strategy fine-tuned. The five challenges faced by introductory MIS course designers were identified as the increased emphasis on flexible delivery, technology-smarter students, students expectations of multimedia teaching approaches, lack of technology and faculty resources, and finally, the dynamic nature of the course content. Examination of these issues resulted in a strategy involving partnerships, assessments, teams and technology (PATT). This PATT strategy was implemented to overcome the identified challenges. Early outcomes of the programme indicate the strategy is successful in terms of student attendance at tutorials, student performance, and faculty satisfaction.

INTRODUCTION

The University of Southern Queensland (USQ) has built a reputation since its founding in 1967 for offering quality academic courses which are recognised worldwide, and in particular for the excellence of its distance education courses. As emphasised in its Mission Statement, USQ provides access for learners from diverse social, economic and cultural backgrounds worldwide, whilst recognizing its pivotal role in the life of its regional communities. USQ's commitment to choice in the modes of delivery of its programs on-campus, off-campus and online, within a people-centred modern communications environment, identifies its distinctive contribution (USQ 2001). USQ is located at Toowoomba in southeast Queensland, Australia. Approximately 5000 students, including about 900 international students from 40 nations, study on-campus, and 13,000 off-campus by distance learning including 3,000 off-shore students (USQ 2000).

USQ graduates are strongly sought after in the workplace, and independent surveys show they have a very high overall satisfaction rate with the standard of the courses and support offered to them. The University is truly student-centred and emphasises learning experiences and individual needs. This case study reports on the approach taken by course designers at USQ to improve the Introductory MIS course offered by the Faculty of Business and Commerce.

The goals of this study were to identify challenges in teaching on-campus introductory MIS courses in a regional university; to identify a strategy to overcome these challenges; and to evaluate the outcomes from implementing the identified strategy.

Measurable Objectives

To evaluate the outcomes from implementing the strategy, the following measurable objectives were formulated. The strategy should result in:

- An increase of 10% in the number of students who pass the course without dropping the pass cut-off mark below 50%;
- An increase of 10% in the number of students who attend lectures and tutorials;
- An increase in student knowledge of unit content measured through a comparison between students' perceived level of knowledge prior to enrolment and after completion of course (see Appendix A for a sample survey);
- A perceived increase in the overall popularity of course and its teaching staff, measured through teaching evaluations of lecturer and tutor;
- An increase in the number of research and scholarship goals achieved by faculty members.

In the next section, the methodology is described, then the identified challenges are discussed. The strategy which was formulated is then detailed, and the outcomes presented with a discussion about future enhancements.

METHODOLOGY

The methodology used for this research is based on action research, combining theory and practice through change and reflection in an immediate problematic situation (Avison, Lau, Myers & Nielsen 1999).

The research consists of three phases. Phase 1 diagnosed the problem, determined the objectives and then formulated the strategy. In this phase, a brainstorming session was conducted with faculty involved in teaching and developing foundation courses. Then the value chain analysis model was applied to identify specific critical leverage points where the Introductory MIS course could be enhanced (Laudon & Laudon 2000). Factors within the tertiary education sector as well as specific to regional universities were considered (Potter 1985). This analysis process resulted in a 4-faceted strategy to overcome the challenges of teaching an introductory MIS course.

In the second phase, action intervention occurred as the strategy was implemented. The student cohort was surveyed to collect and analyse their demographics and their perceived skill level and attitudes towards the foundation MIS course. Then the strategy was implemented by changing the content and delivery of material to on-campus students.

The third phase of the study involved reflective learning as the outcomes were determined and the strategy reviewed and improved. In addition, continued observation for a prolonged period (longitudinal-based) would further confirm the applicability and effectiveness of the strategy.

BACKGROUND

The University of Southern Queensland has placed Foundation Computing as one of its main strategic educational objectives for over a decade. The Foundation Computing course—Introduction to Computing—has a long history of educating first year tertiary students at the University of Southern Queensland. Table 1 shows the number of students enrolled in the course in 1990, 1995 and last year. For some years, the course was offered as a core subject to all USQ undergraduate students, but now other Faculties offer their own course.

In a survey conducted at the start of the 2001 academic year the following demographic information (Table 2) highlighted characteristics of the students studying the Introduction to Computing course. In Queensland, children are aged five years when they commence 12 years of formal schooling. Therefore, most high school students who go on to commence university study immediately after school are aged 17 years. However, the average age of students who were enrolled in this first year course is 20.5 years. This is indicative of the trend of mature-age people undertaking university studies as a result of pressure on individuals to reskill.

CHALLENGES

Faculty staff involved in the Foundation MIS course participated in a brain-storming session which was held

TABLE 1
COURSE FOCUS AND ENROLMENTS

1990	1995	2001
		Time
• University-wide corporate unit (cross- faculty) • General computing studies • Course Enrolments all modes (approx.) • Semester 1 - 800 • Semester 2 - 400 • Semester 3 - 200	• Faculties of Business/Commerce unit • Option for other students • Practical Unit • Some emphasis on information systems • Course enrolments all modes (approx.) • Semester 1 - 400 • Semester 2 - 200 • Semester 3 - 100	• Faculty of Business & Commerce (merged) • Option for other students • IS unit with adequate emphasis on IS technical skills • Course enrolments all modes (approx.) • Semester 1 - 650 • Semester 2 - 450 • Semester 3 - 200

TABLE 2
CHARACTERISTICS OF STUDENTS ENROLLED SEMESTER 1 2001

Number of Respondents	152 (67%)
Age	Mean 20.52 years Standard Deviation 5.83 years
Gender breakdown	53.3% males 46.7% females
Previous computing experience	75% of respondents studied computing in high school 77% of males studied computing in a formal setting 72% of females studied computing in a formal setting None of the students over the age of 33 years had studied computing in a formal setting

in late 1999. It was generally realised that the course needed to be upgraded and that a new approach was warranted. The brain-storming session identified the following challenges.

Flexible Delivery

Increased emphasis on flexible delivery has made it ever more challenging to structure an introductory MIS course in alignment with the needs of students both on- and off-campus. With the emphasis on lifelong learning, many students are mature-aged, bringing with them industry skills and technical experience. Flexible delivery incorporates a range of learning strategies (case, hands-on), learning environments (team, one-on-one, tutorial), learning styles (visual, audio, written), learning interests and needs (fee-based, cross-institutional, career goals, educational goals), and learning opportunities (geographical constraints, cultural climate) (OLIATAFE 2001). At USQ, flexible delivery is achieved through on-campus, external (print-based) and online modes. To cope with these demands, faculty need to be equipped with a diverse range of skills and a variety of technologies need to be utilised to facilitate effective communication with students.

Student Cohorts

The second challenge stems from the trend of high school students enrolling in pre-tertiary computer studies. Consequently, entry-level university students are 'technology smarter' than their predecessors. These predominantly on-campus students perceive themselves as having all of the skills and knowledge necessary to complete the course, without attending on-campus teaching. This over-confidence and complacency often results in poor attendance and performance.

Traditional Teaching

Characteristics of the MTV generation contribute to the third challenge: students' failure to respond to traditional "chalk and talk" approach to lectures and tutorials. In a core MIS course, students expect that cutting-edge technologies will be showcased. They want to be entertained with all the 'bells and whistles' of technology.

Industry Attractions

The fourth challenge is experienced by most IT departments in tertiary institutions: lack of resources. One problem is in attracting and retaining staff with current skills. This is because academic remuneration is substandard to industry norms and there is tremendous demand for IT professionals. IT graduates often earn more than their lecturers. Currently, there are more than 20 vacancies for information systems faculty in Australian universities. This unprecedented demand has resulted from a misalignment between industry and academic remuneration. In addition, there is a marked shortage of skilled information systems professionals in the industry. A recent survey of Australian businesses conducted by the IT Skills Hub through the Australian Bureau of Statistics, found that there will be an estimated 24,000 additional people required to work in core Information and Communications Technology occupations and supporting roles in 2001 and a further 27,500 in 2002 (Alston 2001). This coupled with ever increasing global demand for IS professionals has created a crisis in attracting and retaining suitable faculty.

Universities are under increasing funding pressure to contract out course development and support materials. These strategies are often beyond the means of smaller universities. In addition, there is a need to equip course developers with state-of-the-art hardware, software and data communications equipment. To utilise state-of-the-art technology, campus laboratories must also be re-equipped with necessary hardware and software. All of these requirements put further strain on the faculty budget.

Content Dynamism

The fifth and final challenge identified relates to the ever-increasing rate of technology change which forces continual updating of study materials. New increments of software packages continually lead to new text and materials. These need to be integrated into the existing course. Course developers need to continually update their knowledge and skills to keep pace with technological changes. A diverse and complicated skill set is required of course developers, including hardware, operating system, multimedia, web development, e-commerce, social and ethical issues, networking and communications expertise.

PATT STRATEGY

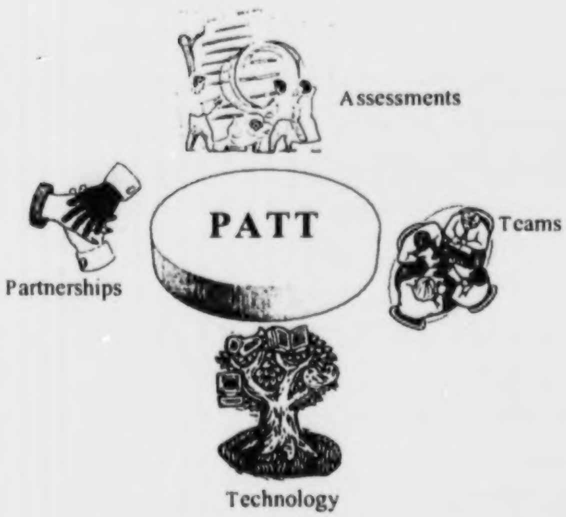
To overcome these challenges, an innovative approach has been developed and trialled with measurable success. This strategy is a multi-faceted strategy, consisting of four elements: student cohort skills assessment, teaching approach, publisher partnerships, and use of Internet technologies. The action research method is structured according to Partnerships, Assessments, Teams and Technology—The PATT Strategy, as it has been termed by the researchers and shown in Figure 1. The derivation process of identifying the PATT Strategy is intricately interwoven in theory and practice—quite appropriate for action research as action research literature was drawn upon, allowing the researchers to react to the contextual needs of research and practice.

Partnerships

Collaboration with publishers of adopted textbooks was leveraged to provide access to state-of-the-art information and up-to-date textbooks. Feedback to the authors of textbooks, maintained through the book publisher, allowed for continual content enhancements to counter textbook deficiencies. This feedback channel also offered the facility for lecturers to request additional text supplements specific to the course objectives.

Publishers have begun to promote the mix-and-match of chapters and/or sections from various textbooks. This

FIGURE 1
PATT STRATEGY



facility, known as Publishing on Demand, allows course designers to focus on course objectives as the basis for text selection—not the other way around. It also has the potential to reduce student expenses; when requiring parts from two books, one book can be published including both parts.

Many publishers now offer teaching support with electronic resources such as instructor supplements, PowerPoint presentation slides, chapter summaries, answers to review questions, course Web sites, and video and image galleries. These useful add-ons were used to assist course developers by reducing staff workload and enhanced the learning experience for foundation MIS students.

At the same time, publishers have also offered course designers remuneration to design supplements or enhance textbooks. The benefits are three-fold: academic recognition for course designers, financial rewards for course designers and ultimately better course materials.

Assessment

At the start of each semester, the skill and knowledge level of incoming students were assessed through the use of surveys (sample included in Appendix A). Results of the survey assisted the lecturer and teaching assistants (tutors) in customising teaching at an appropriate level based on student skill and experience. In conjunction with learning centres located within the university, a collaborative team was formed in which syllabi writers of the learning centres liaise with the course designers to align pre-university computing courses with foundation MIS courses. Alignment does not necessarily imply redundancy of content at the different levels, but building on to previous knowledge to supplement and support active learning at a higher level.

The second area of assessment is pre-entry examinations. This is currently being actively debated as a means of providing exemptions for those who satisfy technology and scholarship criteria of the foundation MIS course. The intention would be that incoming students who perceive themselves to be competent in all aspects of the course be given the option to sit for an examination. To be granted an exemption to the course, students must pass both practical and theory-based questions, and achieve at least 65% overall in the examination.

To maintain student interest in course content, flexibility in the choice of assessments is incorporated on the basis of student's major study areas. Students are offered a range of assignments of various disciplines, including Visual Basic programming for computer programming majors, statistical analysis for economics and marketing majors, and; advanced spreadsheet skills for accounting and finance majors. In order to maintain some structure in the midst of incorporating flexibility, a single realistic business case study is carried through all assessments throughout the entire semester. These assignments are integrated to form a realistic business application, utilising various software packages such as word processors, spreadsheets, databases, presentation software and Web publishing, and combine these technical skills with a systems analysis and business information systems flavour.

Team Teaching

A team teaching approach ensured continuity of course development, supported collaborative teaching, and offered complementary skills. This is one way to reduce the "burn-out" syndrome experienced by teaching staff of entry-level MIS courses. It also allows teaching staff to strike a balance between teaching and other academic and scholarship pursuits.

Traditionally, one team leader was responsible for all course design and management of the unit. As enrolments have grown and the challenges of administering such a large course have escalated, the approach of utilising co-team leaders has been trialled with measurable success. The teaching duties of both the team leader and team moderator have been organised such that these roles are swapped on a semester-by-semester basis, allowing for a synergetic leadership of the course and its teaching assistants. This approach also offers continuity of content, teaching and continual alignment of teaching philosophy. At the same time, this allows the person taking on the role of moderator to pursue teaching in other areas. This approach also allows faculty to undertake recreation leave and/or other personal/research/career pursuits for a substantial duration with no adverse effect on students.

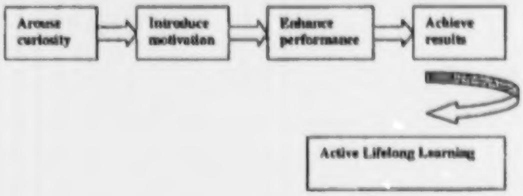
An interactive teaching and learning approach is undertaken in lectures and tutorials. These sessions utilise elements of technology and entertainment such as games (eg. The Weakest Link), debates on contemporary MIS issues, role-plays, student presentations in both learning and as an integral part of assessment, and real-life focused case studies. Table 3 illustrates a few activities undertaken.

TABLE 3
EXAMPLES OF ACTIVITIES UNDERTAKEN BY STUDY MODULE

Study Modules	**Activities Undertaken**
Using Computers	Debate on contemporary issues facilitated ice-breaking and group discussion. Students were asked to briefly research one of the following topics: telecommuting, electronic money, paperless office.
Application Software	Copies of magazine articles and promotional brochures were distributed to students. They were asked to classify these application software packages into appropriate categories, based on a checklist of features which was created in an in-group activity.
The System Unit	Students were presented with a variety of hardware components, including a workable computer. This allowed for a look-and-feel approach to identifying system components and understanding how these components interconnect and operate.
The Internet	Study of the Internet lent itself well to a brainstorming session of previous, current and future Internet-based applications and the impact of these on information systems and society as a whole. Demonstrations of various Internet services and WWW applications such as chat, messaging, plug-ins, videoconferencing were also incorporated in lectures to showcase contemporary innovations on the Web.
Operating Systems	A sketch was set up with groups of students personifying on the different functions of an operating system. Students were asked to 'act-out' the process of memory management, spooling, performance management etc.
Networking	The network laboratory was booked for all workshop sessions to enable students to set up a simple Ethernet network. This assisted them in understanding the various connection types as well as exposed them to various network management software tools, physical transmission media and connectivity hardware.
Mid-semester recap of content	Final year IT project students designed a computer program to simulate the game show *The Weakest Link*. The program was incorporated into a mid-semester lecture session as a means for students to recap their knowledge of content covered in a fun, interactive environment.

These activities above and many others that were used in tutorial and practical workshops are all aimed at stimulating student curiosity to form the basis for active learning (Berlyne 1960). Perception curiosity (surprising or complex sensory stimulus) in the form of multimedia elements were incorporated in all lectures by use of CNN video clips and other sound/video clips related to computing and the paradox of computing. Epistemic curiosity (discrepant thoughts, beliefs and attitudes) was triggered through case study analysis of situations. Students were put in unfamiliar roles in unfamiliar environments e.g. role plays of interaction between components of the computer. This increased arousal and exploratory behaviour in students, reduced discrepancy of understanding and challenged students to look at all facets of a situation. As shown in Figure 2, this approach should help students develop the habits of active lifelong learning.

FIGURE 2
STEPS TO LIFELONG LEARNING



The faculty has also employed a number of final year IT students as *proctors* or student assistants to support the facilitation of teaching in practical workshops. Proctors assist the tutor in initiating and implementing practical workshops. These proctors have previously completed the course and achieved a more than satisfactory grade. The proctor's duty statement includes:

- familiarity with a range of software packages and computer laboratory facilities;
- understanding of assessment requirements; and
- attendance at lectures and teaching team meetings.

TECHNOLOGY

One of the key technologies used in the case is the Internet. The Internet was used as an information dissemination tool, for messaging to students and also provided the capability for an online assessment engine.

Firstly, as an information dissemination tool, the Web was used as a means of encouraging pre-lecture reading and to increase lecture attendance by providing information pertaining to the study module and to the upcoming lecture. Reference materials were also published on the Web where they could be easily accessed and downloaded by students as and when required. With the inclusion of min-versions of lecture slides, students were given a sneak preview of the upcoming lecture and content to promote attendance at lectures.

Secondly, Web messaging technologies were utilised to their full advantage. These included e-mail, mailing lists, discussion groups, and Internet chat facilities. E-mails formed the basis for scheduling student consultation; a fast efficient way of answering short, specific queries; and provided an effective method for course team to communicate with each other in relation to teaching issues.

For information dissemination to external students in Australia and in other countries, mailing lists have been established. The chief advantage of course-specific mailing lists is to facilitate flexibility in course changes throughout the semester. Additions and/or modifications to course requirements can be easily communicated to all students by this method.

Discussion groups were established as a means to promote and facilitate discussion between students. This method has demonstrated its effectiveness in assisting learning and also serves as an avenue for grievance and student support.

Internet-based messaging and chat facilities are also starting to gain popularity in use. The benefits are two-fold: encouraging students to use contemporary technologies that they have learned in the course, and providing another means of feedback and communications loop between faculty and student.

The third internet based technology involved the use of an online assessment engine which allowed students to self-evaluate their skills and knowledge. At the same time, lecturers were able to use statistics of access times and assessment results to track student participation levels and identify weak knowledge areas. Web online assessment systems provided by book publishers greatly reduced the workload of course designers in the preparation of quizzes and feedback sheets. Publishers provide server facilities for storage and management of these quizzes as well as data on student participation in quizzes, student activity on the site and quiz results. These assessments can either be formative or summative, depending on course requirements. To date, the technology is still on trial and therefore, only formative assessments have been used.

Issues that need to be considered when choosing an online Web-based assessment engine include cost to students and the university, server reliability and performance, ease of management and flexibility of assessment styles. With substantial student numbers, most book publishers offer the use of the engine at nominal or no cost to students and the university. The physical location of the engine is an important consideration. Some institutions choose to set up their own servers residing on-campus to host the assessment engine. Others prefer the benefits of outsourcing the maintenance costs and performance management issues to the book publishers. All assessment engines should contain a user-friendly interface for managing student data, student results, and administering assessment items.

The content that can be assessed through an online assessment engine offered by book publishers is directly related to the adopted textbook. Other content is not usually permissible on the engine. Unfortunately, such online assessment engines tend to focus only on the theoretical components. For courses that assess both theory (computing concepts and principles) and practical components (technical word processing, spreadsheet and database skills) of their foundation MIS courses, other assessments need to be designed to test practical skills. Online assessments are popular with many students as the feedback is immediate and the tests can be taken at a time and location convenient to the student. This form of assessment provide initial extrinsic motivation which is advocated by Lepper (1988) to nurture intrinsic motivation to learn.

FINDINGS

To date, measurable positive impact has been achieved in implementing the strategies outlined above. Some quantitative measures include student retention at lectures and tutorials, movements between tutorials and pass rate. These are detailed in Table 4.

Tutorial staff acknowledge that though the PATT strategy initially increased their workload in regard to materials development, they see a direct flow through benefit to themselves in regard to higher student attendance and participation. Testimonials of tutors include "... classes are running smoother, students are enjoying learning and I don't feel as drained at the end of the day as I once did"; "... they want to know more, the multimedia elements are just whetting their appetites."

Website and news group usage monitoring further highlight the impact of the PATT strategy. Previous to the strategy adoption in semester 1, hits to the unit website averaged seventeen per week, currently unit website hits exceed 2,500 per week. Active participants in news group discussions numbered on average thirty-five prior to the PATT strategy adoption, currently fifty-five percent of external students and thirty percent of internal students are using this resource.

Some qualitative feedback obtained through course evaluation surveys conducted at the end of the semester revealed that students were satisfied with the knowledge and skill building activities both in lectures and tutorials, and felt that the strategy had allowed them to build upon the performance in both theoretical and practical aspects of the course.

In order to boost students' interest and participation, the course designers deliberately attempted to include an element of fun in the lectures and tutorials. Although Gagne and Briggs (1979) warn that 'fun' learning may detract from students comprehending and analytically understand concepts, in this case, many students commented positively about this aspect: "(name)'s teaching made learning computing interesting, I got more out of the lectures and tutes than I ever did at high school." ; "... made learning about computers fun, I was dreading this course, but now I'm considering doing more computing courses".

As with any major change in teaching approach and organisation, the supply and management of resources are major issues. There is a need for a champion sponsor to undertake the responsibility of ensuring resources are ample and logically allocated. In the case study, the Head of Department was an active participant at meetings, was actively making decisions with the course team, and developed some teaching methods to support the implementation of PATT. The PATT strategy also requires a leader to encourage a team of self-motivated, independent and diligent educators with the mindset of educating and supporting students in the first year of tertiary studies.

TABLE 4
PATT OUTCOMES SEMESTER 1 2001

Evaluation Criteria	Semester 1 2001	Semester 1 2000
Student retention at lectures	Increase of 15%	Control
Student retention at tutorials	Average: 80% attendance	Average: 65% attendance
Movement between tutorials	Dynamic in the first two weeks of the semester	Rigid tutorial placement
Pass rate	62% pass rate	49% pass rate

CONCLUSION

The strategy described in this paper provides practical guidance for introductory MIS course designers who are looking for cost-effective ways to develop and redevelop technology-intense course materials. Course designers are urged to make full use of support from publishers, and to include Internet tools to facilitate material availability and communication. This research concludes that the challenges of teaching to a diverse, technology-smart entry-level cohort can be overcome by understanding the characteristics of the students and building flexibility into course delivery and assessment.

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APPENDIX A
SAMPLE STUDENT SURVEY

Personal Particulars

1. Are you predominantly
   G a day student G an external student G a USQOnline student

2. Age __________ years

3. Gender
   G Male G Female

High School Education

4. Were you
   G private high school G state high school student

5. Name of high school ______________________________

6. Did you do any computing studies in high school?
   G Yes G No

If no, go to Q8.

7. If yes:
   G junior high computer
   G senior high computer studies – Information Processing and Technology
   G senior high computer studies – Computer Studies (CS)
   G senior high computer studies – Business Communications and Technology
   G other

Use of Computers

8. Have you ever used a computer?
   G Yes G No

   If no, go to Question 13.

9. When did you first use a computer? Year ______

10. Do you have a computer at home?
    G Yes G No

    If no, go to Q12

11. If yes, when did you first get your first computer at home? Year ______

12. On average, how many hours per week do you spend on a computer?
G 0-2 hours G 3-6 hours G 7-10 hours G more than 10

13. **Computing Skills**

Please rate the following statements based on your **skill** in using the following.

	Limited expertise		Moderate expertise		Expert	N/A
Word processors	☐	☐	☐	☐	☐	☐
Spreadsheets	☐	☐	☐	☐	☐	☐
Database systems	☐	☐	☐	☐	☐	☐
Presentation software	☐	☐	☐	☐	☐	☐
Desktop publishing software	☐	☐	☐	☐	☐	☐
Accounting and financial software	☐	☐	☐	☐	☐	☐
Drawing packages	☐	☐	☐	☐	☐	☐
E-mail	☐	☐	☐	☐	☐	☐
Newsgroups	☐	☐	☐	☐	☐	☐
Internet chat software	☐	☐	☐	☐	☐	☐
Internet browser	☐	☐	☐	☐	☐	☐
FTP	☐	☐	☐	☐	☐	☐
Gopher	☐	☐	☐	☐	☐	☐
Programming languages (e.g. COBOL, Pascal, Visual Basic, Java)	☐	☐	☐	☐	☐	☐
Computer games	☐	☐	☐	☐	☐	☐
Obtain and play music (e.g. MP3s)	☐	☐	☐	☐	☐	☐

14. **Frequency of Use**

Please rate the following statements based on the **frequency of use per week** in the following computing skills.

	1-3 hours	3-5 hours	5-8 hours	8-10 hours	Greater than 10	(N/A) Never
Word processors	☐	☐	☐	☐	☐	☐
Spreadsheets	☐	☐	☐	☐	☐	☐
Database systems	☐	☐	☐	☐	☐	☐
Presentation software	☐	☐	☐	☐	☐	☐
Desktop publishing software	☐	☐	☐	☐	☐	☐
Accounting and financial software	☐	☐	☐	☐	☐	☐
Drawing packages	☐	☐	☐	☐	☐	☐
E-mail	☐	☐	☐	☐	☐	☐
Newsgroups	☐	☐	☐	☐	☐	☐
Internet chat software	☐	☐	☐	☐	☐	☐
Internet browser	☐	☐	☐	☐	☐	☐
FTP	☐	☐	☐	☐	☐	☐
Gopher	☐	☐	☐	☐	☐	☐
Programming languages (e.g. COBOL, Pascal, Visual Basic, Java)	☐	☐	☐	☐	☐	☐
Computer games	☐	☐	☐	☐	☐	☐
Obtain and play music (e.g. MP3s)	☐	☐	☐	☐	☐	☐

15. **Attitudes**

How would you rate your level of **agreement** with the following statements?

	Strongly disagree			Agree			Strongly Agree	N/A
Computing skills are important to me.	☐	☐	☐	☐	☐	☐	☐	☐
Computers help me to learn.	☐	☐	☐	☐	☐	☐	☐	☐
A computer is a useful tool for me.	☐	☐	☐	☐	☐	☐	☐	☐
I feel it is difficult to use a computer.	☐	☐	☐	☐	☐	☐	☐	☐
Computers are as important to students as textbooks.	☐	☐	☐	☐	☐	☐	☐	☐
Computers make better thinkers out of students.	☐	☐	☐	☐	☐	☐	☐	☐
I use the computer effectively.	☐	☐	☐	☐	☐	☐	☐	☐
I think computers should be used wherever possible.	☐	☐	☐	☐	☐	☐	☐	☐
When I have a choice I prefer to use a computer for some tasks.	☐	☐	☐	☐	☐	☐	☐	☐
Educational curricula should be reorganized to make maximum use of computers.	☐	☐	☐	☐	☐	☐	☐	☐
Computers isolate students from one another.	☐	☐	☐	☐	☐	☐	☐	☐
I enjoy using a computer.	☐	☐	☐	☐	☐	☐	☐	☐
Owning a computer is highly desirable.	☐	☐	☐	☐	☐	☐	☐	☐
I object to the attention being given to computers.	☐	☐	☐	☐	☐	☐	☐	☐
I object to the attention being given to the Internet.	☐	☐	☐	☐	☐	☐	☐	☐

TEACHING DATA WAREHOUSING TO GRADUATE STUDENTS—A CASE STUDY

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ABSTRACT

This paper describes efforts at the Department of Informatics of University of Pretoria to teach the principles of data warehousing to graduate students. The aim of this project was to teach students the complexities of a real world data warehousing effort. Students, who worked in groups of two, were required to design and implement a data warehouse using a data repository concerning data as collected in the Pretoria region of the Gauteng Province of South Africa, during the 1991 and 1996 Censuses.

To ensure that the real world is simulated as well as possible, the quality of the final data warehouse was analysed by considering how well the user requirements were being met. The success of this teaching approach was assessed through questionnaires and informal interviews, to determine the level of cognition attained by the individual students. The resultant data warehouse will subsequently be used for a data mining effort, concerning the analysis of health issues and the occurrence of crime in this region.

INTRODUCTION

Data warehousing and its related technologies are increasingly considered a way of addressing the strategic needs of an organisation (Berson, 1998; Gray & Watson, 1996). Successful data warehouses support the decision support requirements of businesses by providing integrated, high-quality subject-oriented information that has been collected over time. This is done through careful integration and aggregation of current and historical data from different operational systems (Inmon & Keller, 1994). The data warehouse's focus is on the *analysis* of integrated operational data from various sources, differing considerably from operational databases' goal of recording and completing business transactions, implying different database design techniques.

Although data warehousing provides information to potentially support critical success factors, a large number of well-funded data warehouse projects fail nevertheless. Many factors contribute to the failure of data warehouse projects. According to Adelman (1998) and Gibbons (1997), amongst others, the failure of main data warehousing efforts is largely due to unhappy users and the perceived poor performance of the system, caused by unfounded user expectations. This opinion seems to be shared by many practitioners: in a survey of attendees of a Data Warehouse Institute conference, the most important critical success factors of a data warehousing effort were identified as upper management support and user involvement (Gray & Watson, 1998). Greenfield (in Mallach, 2000:584) emphasises user involvement by calling data warehousing a joint user/builder project and responsibility. It is thus clear that end-user involvement throughout the development process is generally considered as of crucial importance.

The teaching of data warehousing usually takes place in a regulated and predictable classroom environment. The curricula typically covers the theoretical aspects of data warehousing i.e., the data warehouse methodologies, data modelling, extraction, transformation and transportation, data management, access and reporting. The practical component involves an introduction to enabling technologies and possibly a practical project.

This paper describes a different approach to data warehousing teaching. The Department of Informatics of University of Pretoria (UP) offers a data warehouse course to graduate students, who are considered to be familiar with the fundamentals of data modelling, data integration and the necessary technologies. The course covers theoretical aspects of data warehousing as well as an introduction to the enabling technologies. The course also includes a data warehouse project, using a relational database management system (DBMS) such as Oracle or SQL Server. Since it is assumed that students have mastered the basics of data modelling, the focus of the course is more on exposing students to the problems surrounding real life development and implementation of data warehouse solutions, as described here.

The paper is organized as follows. Section 2 briefly introduces a number of data warehousing methodologies and discusses the pros and cons of each technique. Section 3 provides a brief justification of the teaching and learning approach, implementing the idea of 'reflective practitioner' first introduced by Schön (1987). The section also shows how the learning approach relates to Bloom's taxonomy of educational objectives. Section 4 describes the data warehousing case study. In Section 5, results and feedback from students are also discussed. Finally, Section 6 concludes the paper.

DATA WAREHOUSING METHODOLOGIES

With the advent of data warehousing, organisations are investing huge amount in order to obtain information from their vast data repositories. The main aim of most data warehousing efforts is the expected ROI, due to the perceived improvement in decision-making capabilities.

To this end, a number of data warehousing development methodologies have been proposed, ranging from the "big bang approach to the iterative, incremental approaches (Gray and Watson, 1998; Hammergreen, 1996).

In the big bang approach, the data warehousing project is attempted in one phase. That is, the development of the data warehouse is seen one huge task to be completed at once. This approach is well suited to an environment where it is completed as part of a business re-engineering exercise. However, the big bang approach is considered a high-risk approach, since user requirements and technologies could change before the project is completed.

With the iterative, incremental approaches, the data warehouse is developed in increments, whilst complying with a full-scale data warehousing architecture. That is, an enterprise-wide "road map is provided, which are then used to incrementally develop data marts for only one or two subject areas. In this way, the user is incrementally provided with usable information, while the data warehouse designers are being provided with the possibility to adapt the functionality of the system after each increment.

The top down iterative approach is mainly driven by the business benefits and is widely recommended as a method that is quick to implement. Here, the *business requirements* are determined and a conceptual information model is formed. This method thus focuses on the creation of a flexible data warehouse architecture that could withstand the pressures of dynamic environments with unpredictable uses. On the other hand, the bottom up iterative approach focuses on the *data*, which resides in operational databases, legacy systems and external sources. Instead, the relatively quick implementation and focus on high-level business needs of the top down approach and the ready at hand data sources for initial application development of the bottom up approach make a combination of the two approaches a viable option (Mallach, 2000).

Whichever method is chosen, high user involvement and analysis of enterprise requirements to identify and prioritise subject areas stay important (Mallach, 2000; Greenfield in Mallach, 2000). However, it is clear that this user-centred approach is not well suited for the classroom environment. Real world users are difficult to find, due to the high costs associated with building a data warehouse, the time consuming nature of this exercise, etc. This leads to the danger that scoping and the identification of requirements to use in the approach become only a theoretical exercise, with the students thus adopting a typical IT driven bottom up approach.

Research shows clearly that although theoretical and technological know-how regarding data warehouse development are necessary conditions for success, the skills of working with end-users and interpreting user requirements are critical success factors. The involvement of users introduces a human element, which often results in unpredictable and uncertain situations. The teaching approach described in this paper, focuses on fostering those skills necessary to handle real-world situations of which end-users are very much part of. The following section provides a theoretical background for our chosen approach.

EDUCATING REFLECTIVE DATA WAREHOUSE DEVELOPERS

Arnold Schön first introduced the concept of the "reflective practitioner. The idea was born from the concern that professionals are not ready for the demands of the real-world practice. Schön (1987) argues that the education of professionals is largely based on a positivist epistemology of practice, called technical rationality. Technical rationality holds that practitioners are instrumental problem solvers who select technical means best suited to particular purposes. The assumption is that "Rigorous professional practitioners solve well-formed instrumental problems by applying theory and technique derived from systematic, preferably scientific knowledge. (Schön, 1987:4). However, experience shows that problems in real-world practice present themselves as messy, indeterminate situations. The way in which we deal with these unstructured problems is by giving it structure through 'naming and framing' and only then applying technical problem solving.

Schön argues that we need to teach those competencies that enable the professional to make decisions under conditions of uncertainty, i.e., to prepare the professional for the uncertain zones of practice. The argument is not against scientific knowledge, but for the recognition of the importance of the competencies displayed in uncertain and conflicted situations of practice. Schön considers the 'wisdom', 'intuition' or 'talent' that enable professionals to handle indeterminate zones of practice, as professional artistry.

The question then arises whether it is possible to teach "professional artistry. To find an answer to this question, Schön directs his attention to the teaching of the arts: the dance school, the music class, the architectural design studio etc. Here he finds *coaching* instead of *teaching* and above all *learning by doing*. Schön describes the activities perceived in these settings as *reflection-in-action*. The teacher provides an uncertain situation (for both the teacher and student) and engages with the student in dialogue in the form of reciprocal reflection-in-action. Reflection is induced by constant surprises as a result of the uncertain situation. Students (and teachers) are forced to reflect on previous and future actions. Through reflection, the student adjusts his/her actions and knowing about the subject matter that eventually lead to wisdom and the refinement of intuition.

Reflection-in-Action and Bloom's Taxonomy

It is the opinions of the authors that the simulation of a real world scenario provides students with an understanding of not only data warehouse concepts but also the difficulties surrounding data warehouse success. We believe that the success of the 'reflective practitioner' approach lies in the fact that all levels of Bloom' taxonomy of educational objectives are being addressed and assessed.

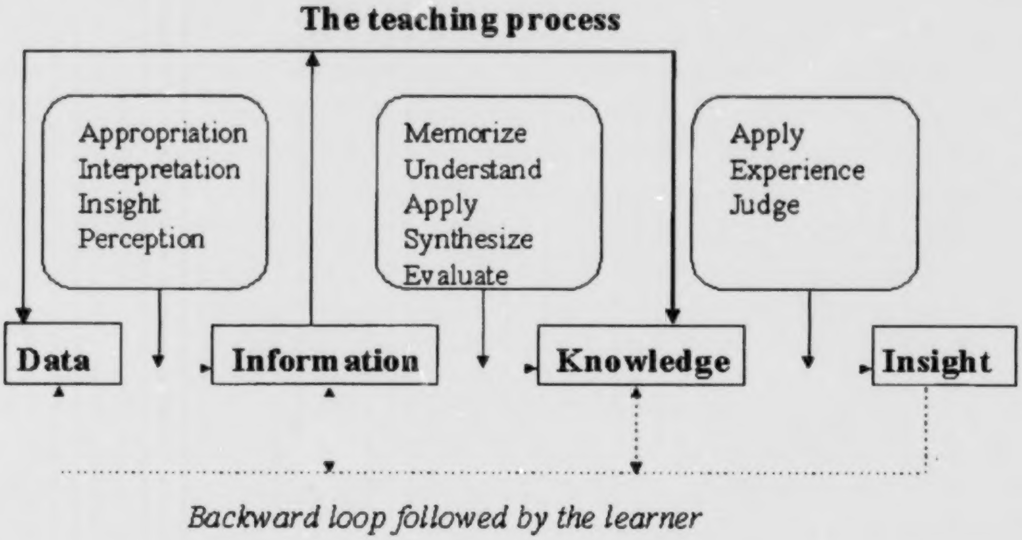
According to Bloom's taxonomy, students need to be able to have knowledge and comprehension of the subject matter, be able to apply the knowledge, analyse and synthesise the concepts and lastly to be able to evaluate the concepts and methods on both a qualitative and quantitative level [Matthee, 1998]. Bloom distinguishes between six levels of knowledge (in order of complexity), namely remembering of facts, understanding, application, analysis, synthesis and evaluation. Van Loggerenberg (1995) showed that there is a relationship between Bloom's taxonomy and data, information, knowledge and wisdom or competence [De Villiers, 1996]. According to De Villiers (1996), for learning to take place, the lecturer should be able to convert her knowledge of information back into data, to enable the student to become competent in the subject matter. This process is depicted in Figure 1. The highest level of cognition, according to Bloom (1956), is thus evaluation, which is achieved when the student is able to apply his knowledge in an experienced matter and is able to reason about possible solutions. This level of cognition is seldom reached in the traditional teaching of data warehousing concepts, since students usually do not receive sufficient feedback (from the user) regarding their projects.

The aim of the data warehousing project is therefore to create such a setting, i.e., a setting that forces reflection-in-action. This is done by simulating a real-world data warehouse development scenario, through the involvement of real life users in the form of the department's data mining research group, which are actively involved throughout the development process. The next section describes the data warehousing case study and the user requirements in more detail.

DATA WAREHOUSING CASE STUDY

A data warehouse is usually constructed from a number of organizational databases, together with external data repositories, typically including governmental Census databases and other repositories containing relevant market indicators. Data warehouses provide historical snapshots of the organization, its evolution and its data capturing processes. Practitioners agree that data warehousing is often a daunting task, due to a number of factors including the difficulty with ensuring user buy-in, the data quality issues associated with the extraction, transformation and transportation (ETT) of the data, poorly defined user requirements and unrealistic user expectations, amongst others.

FIGURE 1
THE LEARNING PROCESS
(Adapted from De Villiers, 1996)


The teaching process
Appropriation
Interpretation
Insight
Perception
Memorize
Understand
Apply
Synthesize
Evaluate
Apply
Experience
Judge
Data
Information
Knowledge
Insight
Backward loop followed by the learner

In an attempt to assist students to experience these difficulties first hand, students were given the task to create a data warehouse through the utilization of a Census data repository. The Census data repository concerned the 1991 and 1996 Censuses of the Greater Pretoria Metropolitan Council area located in the Gauteng Province of South Africa. Approximately 3 million people, residing in formal or informal settlement within rural and urban areas, inhabit this area.

The data from the two Censuses were placed in a data repository totalling approximately 214 Mbytes and consisting of 23 tables. One of the features of this data repository is the fact that it is spatially orientated and includes summarised information. That is, the data are used in conjunction with a geographic information system (GIS). The tables thus include a GIS Key attribute, which denotes one of 2606 regions on the map of the greater Pretoria area.

Table 1 depicts a subset of the tables contained in repository. The figure shows that, for each of the different regions, demographic (summarized) information regarding the inhabitants was stored. For example, the age, citizenship, first language, race and gender of the inhabitants, amongst others, were collected. In addition, the Census data warehouse also contained information regarding the living conditions within a region. For example, the type of fuel used for lighting (gas, open fire or electricity), the type of telephone facilities and type of refuse disposal were recorded. Most of the tables included information regarding the four population groups (Black, Coloured, White and Asian-Indian) together with the Gender. For example, Table 2 shows a table containing information regarding the incomes of the various groups within a region. For example, the table shows that, in region 7010734, there are thirty Black Females with income between ZAR5 000.00 and ZAR10 000.00.

TABLE 1
CENSUS DATABASE TABLES

Region and Country of Birth by Gender by Population Group
Region by Age by Gender and Population Group
Region by Individual Income (Monthly) by Population Group and Gender
Region by Water Supply by Population Group and Gender
Region by Type of Dwelling by Population group of Head of Household and Gender
Region by Number of Rooms by Population Group and Gender
Region by Disability Summary by Population Group and Gender
Religion by Population Group

Students were subsequently given the task to construct a data warehouse from the Pretoria Census data, as discussed next.

User Requirement

The users' levels of involvement in the development of the data warehouse included initial and follow-up joint application development (JAD) sessions, a number of consultation sessions, evaluation and improvement of the initial design of the data warehouse, together with the evaluation of the final product. This evaluation was based on the usability and performance of the data warehouse in terms of the data mining efforts.

The users indicated that the main aim of the data warehouse is to aid them to analyse the quality of life in the different regions of Pretoria. This information supports the identification of additional interrelationships, basic trends and thus the possible discovery of new knowledge. For example, the interrelationships between level of education, electricity supply and level of crime are of importance. These results will

TABLE 2
REGIONAL TOTALS OF MONTHLY INCOME FOR EACH GENDER AND POPULATION GROUP

GISKey	*Race*	*Gender*	*Criteria*	*Total*
7010734	Black	Male	R5000-R10000	44
7010734	Black	Female	R5000-R10000	30
7010734	Coloured	Male	R5000-R10000	10
7010734	Coloured	Female	R5000-R10000	8
...				

subsequently be linked to health issues and crime statistics. In particular, the Census data warehouse will be used to aid the data mining effort regarding tuberculosis (TB) diagnosis. In particular, the question whether there is a correlation between standards of living (as per this data set) and TB occurrence will be addressed. Students were therefore also given the (optional) choice to incorporate the South African Public Health Database into the data warehouse.

The quality of human life depends on the quality of his environment. According to the South African Demographic and Health Survey of 1998 (Department of Health, 1998) there can be a correlation between the human, his environment and background characteristics, and the prevalence of disease. In the report only the prevalence of symptomatic asthma and chronic bronchitis are documented and it seemed important to the user to determine whether the same would be true for the occurrence of TB cases.

Non-urban participants of the survey, report the symptoms of the above-mentioned diseases more frequently than their urban counterparts. South Africa is divided into nine provinces, namely Gauteng, Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu Natal, Mpumalanga, North West and Northern Province. For both diseases the Northern Province reported the lowest rates whereas North West Province reported the lowest rates for chronic bronchitis in woman. Women more frequently than men, and older people rather than younger persons, report symptoms of asthma and chronic bronchitis. Low levels of education are strongly associated with high rates of both conditions, but differences by ethnic group were reportedly small.

By using the Census data, which contains various background and environmental indicators, one should be able to determine certain contributing factors to low quality of living and link these to a certain region and probably to the occurrence of disease.

The users thus indicated that the students were expected to design a data warehouse containing data that could be used to determine a region's quality or standard of living. Comparing these with the TB prevalence data from the same region thus would enable healthcare workers and planners to identify problem areas within regions.

After evaluation of the original data repository, 102 areas within the Pretoria region were selected to be included in the data warehouse. These areas ranged from rural to urban, with a mixture of population groups and genders. Seven of the original tables were selected that had to be used by the students in the building of the warehouse, since these tables were thought to be indicators of quality of health. The criteria selected as indicators ranged from fuel used for cooking, to number of rooms per household, income, refuse disposal type, toilet facilities, water supply and household size. Students were required to use this information to construct a data warehouse concerning the quality of life of the inhabitants, as discussed next.

OVERVIEW OF PROJECT

Students were required to complete the project in groups of two or three, using the DBMS of their own choice. The project consisted of two stages, as follows.

Stage 1: Initial Planning and Design

The first stage involved the initial planning and design of the system. The aim of this first part was for students to determine the scope and boundaries of the system. The students were required to hand in a report describing the organizational **strategy** and the objectives of the project, provide **definitions** to define the scope and boundaries of the main aims of the project, **analyse** the organizational requirements and objectives and **design** the data warehouse. The design phase involves formalizing the business rules, the data warehouse dimensional model (star scheme), modelling of summation and time, as well as the creation of the initial physical model.

Stage 2: Implementation and Data Loading

The second stage concerned the actually implementation of the data warehouse using a relational DBMS. The majority of students used Oracle 8i, while others used SAS, SQL Server and MS Access in conjunction with Visual Basic, Delphi or Crystal Reports. Here, the students were required to **build** the warehouse through the creation and testing of the database structure, **extract, transform** and **transport** (ETT) the data, and develop appropriate querying and reporting facilities.

In order to successfully complete a data warehousing project, a number of processes need to be addressed throughout the development. It should therefore be assured that the business requirements are being met; sound data acquisition approaches are followed; the most appropriate data warehouse architecture is selected; the high quality of the data within the data warehouse is assured; data administration and data access control take place; metadata policies and procedures are in place; thorough documentation is kept; adequate testing and training are scheduled; transition policies are in place and post-implementation support is provided for. Students were thus also required to complete (and document) these processes throughout the data warehouse project's two stages.

The success of our approach was evaluated by considering the level of cognition achieved by the students, as discussed next. In addition, the data mining group assessed the quality of the data warehouse by determining the usability thereof, measured by the amount of information they were able to obtain from it.

FEEDBACK/EVALUATION OF LEARNING

It is the opinion of the authors that the simulation of a real world scenario provided students with an understanding of not only data warehouse concepts but also the difficulties surrounding data warehouse success. We believe that the success of the method lies in the fact that students are forced to reflect on their actions and consequently develop 'professional artistry'. Although it is difficult to determine to which extent students attained these skills, students' learning was evaluated on different levels, as discussed next.

The student's efforts were evaluated by determining how well the users' expectations were being met. That is, the success of the exercise was measured by considering whether the business needs were satisfied. The majority of the projects did meet the need of the users, where the users where able to obtain relevant information from the systems. The level of user satisfaction ranged from 50% to 95%, with an average of 78%.

The actual methodology used was also assessed, i.e., it was determined whether the students actually used a top down or bottom up iterative approach, or a combination thereof. This was determined through unstructured interviews during the project demonstrations, as discussed next. The majority of the students employed a combination of the top down and bottom up approaches. That is, the user requirements were used to develop the initial data warehouse conceptual design (star schema). However, students agreed that they also consulted the database itself when creating this schema. This practice corresponds closely to real-world data warehousing efforts, where the developers need to take both the user requirements and the data constraints into consideration during the design and implementation stages.

Students were also given the opportunity to, through questionnaires, share their experiences of the data warehouse development process and voice their opinion on the factors necessary to ensure data warehouse success. The questionnaire is in attached in Appendix A. Tables 3 to 5 summarize the responses received from the sixty students who participated in this study.

Table 3 shows that students were made aware of the importance of clear user requirements to successfully complete a data warehousing effort. Most students agreed that clear user requirements are paramount to ensure the success of a data warehousing effort. It is well known that the clear understanding of user requirements is difficult in information system analysis and design. This fact is augmented in a data warehousing project where users usually wish to obtain "ad hoc results through "what if analysis. Interestingly, the students found the user expectation to be frequently unrealistic. This also corresponds to the real world environment, where practitioners agree that the management of user expectations is difficult. According to Berson and Smith (1997), it is not uncommon for data warehousing system to fail to meet the high expectation of its users. This fact is mainly due to the domain specific nature and summarized nature of the information contained in most data warehouses.

In the second part of the questionnaire, students were requested to arrange eight common mistakes, which influence data warehousing success in order of importance. The resultant ordering is depicted in Table

TABLE 3
PERCEPTION OF USER REQUIREMENTS BY STUDENTS

	Always	*Frequently*	*Seldom*	*Never*	*Average*
Successful data warehousing depends on clear user requirement	42	14	1	1	3.6
Clear user requirements more important than user involvement	3	24	23	10	2.3
User expectations unrealistic	12	36	2	0	2.7

4. The table shows that the students did realize the importance of clear user requirements, the importance of ensuring high quality data and the difficulty associated with the ETT processes. The table also shows that the students generally underestimated the technical requirements of the project, another frequently occurring phenomenon in real-world data warehousing project.

TABLE 4
COMMON MISTAKES
INFLUENCING DATA WAREHOUSE SUCCESS

1. No user involvement throughout the development process
2. Loading the data warehouse with irrelevant data
3. Underestimating the technical requirements
4. Starting without the right executive sponsor
5. Choosing a technology-oriented rather than a user-oriented manager
6. Believing data warehousing design is the same as transactional data warehouse design
7. Delivering data with overlapping and confusing definitions
8. Having unhappy users

Students were also given the opportunity to provide anonymous feedback with respect to the usefulness of the data warehousing project. Table 5 shows some of the feedback received. The table shows that the students generally perceived this as a challenging, but worthwhile project. During informal discussions, many students agreed that the ETT processes were the most time consuming and tedious part of the data warehousing effort. Especially, the transformation of the data from its “horizontal spatial format to the “vertical fact and dimension tables of the star schema was time consuming. The rather vague user requirements were also perceived as a problem. Interestingly, the users found the quality of the majority of final projects outstanding. That is, the projects produced by the majority of our students surpassed the users' expectations. Many students developed graphical user interfaces (GUIs) through which the users were able to formulate their own “ad hoc queries and this perform “what if analysis. The users were therefore satisfied that the majority of their queries regarding the quality of life in the region Pretoria could be answered and that their requirements were being met.

TABLE 5
SOME FEEDBACK RECEIVED
FROM THE STUDENTS

The data warehousing project proved to be an exciting learning experience and utterly unforgettable.

It was a good learning experience, but better user requirements would have helped.

First encounter with this type of project gives one a better understanding of the concepts behind a good data warehouse design.

It was very interesting….

A good learning experience, just a bit confused with the user requirements at first.

The knowledge gained was significant and relevant.

A challenge… very relevant experience.

Good experience: it was tough! I had a real mindshift…

Getting the data “right was much more effort than I anticipated. It was really rewarding.

CONCLUSION

Many lectures agree that it is difficult to teach students the complexities associated with large-scale projects, such as data warehousing, in a simulated classroom environment. The aim of the data warehousing effort described here was to provide students with a hands-on experience of the intrinsic difficulties of this approach. That is, the approach was aimed at provide students with the skills to make decisions under conditions of uncertainty, in order to prepare them for the uncertain zones of practice where user requirements are vague and the quality of the data repositories are not ideal. It is the opinion of the authors that the method described here aided students in achieving the highest level of cognition of Bloom's taxonomy, by providing the student to be able to apply his knowledge in an experienced matter. In the words of one of the students, "*the data warehousing project proved to be an exciting learning experience and utterly unforgettable.*

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APPENDIX A
QUESTIONNAIRE

Please answer the following questions by using the given scale:

4	3	2	1
Always/Definitely	Frequently/ Nearly almost	Occasionally/ Seldom	Never

1. The success of a data warehouse project depends on clear user requirements.

   4 3 2 1

2. User involvement throughout the data warehouse development is not so important provided that the user requirements are clear.

   4 3 2 1

3. Users usually have unrealistic expectations from data warehouse solutions.

   4 3 2 1

List the following common mistakes influencing data warehouse success in order of importance. That is, mark the mistake with the biggest effect as 1, the second most important as 2 etc. Base this on your experience and common sense.

☐ Underestimation of technical requirements (capacity, performance,...). ___
☐ Starting without the right executive sponsor and a good driver. ___
☐ No user involvement throughout the development process. ___
☐ Loading the data warehouse with irrelevant data. ___
☐ Believing that data warehouse database design is the same as transactional database design. ___
☐ Choosing a data warehouse manager who is more technology-oriented than user-oriented. ___
☐ Having unhappy users. ___
☐ Delivering data with overlapping and confusing definitions. ___

P.T.O

Do you think the Census data justifies the construction of a data warehouse? Give reasons for your answer.

Do you have any general comments on this data warehouse project?

Thank you for your participation!

A FIRST STEP IN PREPARING END-USER SUPPORT SPECIALISTS

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ABSTRACT

Specializations within Information Systems (IS) are becoming common, with one of the specialized areas being End-user Support (EUS), but no specific curriculum exists for EUS. This paper discusses the development of an EUS course that combines theory and student projects to simulate the duties found in user support. EUS specialists must be prepared to provide technical support, train end-users, and assist in solving business problems. The course uses group projects, hands-on tasks, and work with end-users to develop the skills needed to be a successful support person. Continued efforts will enhance this course and help develop new courses to meet the diverse needs of this new specialized area within IS.

INTRODUCTION

The introduction of the personal computer (PC) has changed how we do business. Required functions within organizations, and the way they are accomplished, will never be the same. Software application programs are more capable than their predecessors, and these packages allow users to develop and maintain their own applications. Proliferation and networking of PCs and user-friendly application software has created an area in IS referred to as end-user computing.

Researchers have addressed many issues associated with end-user computing, such as end-user satisfaction [7], management of end-user computing [1, 5], and the "how-to necessary to support end-users [4, 6, 8]. Most of these studies and IS programs themselves are geared toward the traditional systems development professional individuals who will most likely enter the workforce as a programmer or analyst. Preparing information systems (IS) professionals to provide End-user Support (EUS) has traditionally received little attention [2, 3]. Efforts have been made to identify the skills necessary for EUS specialists, and such programs are being developed. Details concerning a course designed to introduce students to a possible career specializing in EUS follow.

THE NEED FOR End-user COMPUTING

End-user computing can be defined as *the direct hands-on use and/or development of IS by system users*. Many reasons exist for the advancement of end-user computing, and the need for people with support skills continues to increase. As IS and information technology (IT) continue to permeate nearly all business settings, IS/IT departments struggle to meet the needs of users. End-users have discovered that they can control a portion of their destiny and meet their own needs by developing and/or purchasing their own solution(s). Other reasons for the advancement of end-user computing include lower cost and greater accessibility of software and hardware, and an increasing computer literacy of the business workforce. This increase in end-user computing has led to many management challenges, one of which is providing an adequate support function to meet the diverse needs of end-users.

END-USER SUPPORT

EUS is a broad term encompassing many areas, and the responsibilities of an EUS specialist are very different from those of traditional systems development IS professionals. End-users need training on software, hardware, and procedures, just as much as they need technical support. Supports specialists must provide software training, system consulting, technical support, software documentation, hardware consulting and support, and development support. Support specialists must also have a diverse set of technical skills, including (but not limited to) hardware, software applications, networks, database systems, Internet, and operating systems. In addition, concepts such as problem solving, communication, and interpersonal skills play a vital role in the success of a support specialist.

TABLE 1
TOP FIVE AREAS OF JOB GROWTH RATE 1998 TO 2009

Job Titles	Projected Growth
Computer Engineers	108%
Computer Support Specialists	102%
Systems Analysts	94%
Database Administrators	77%
Desktop Publishing Specialists	73%

As Table 1 highlights, the top five areas of job growth from 1998 to 2008 are computer related, and computer support specialists rank second with a 102% projected growth rate [10]. Based on the *InfoWorld* 2001 Compensation Survey (http://www.infoworld.com/pd/2001iwcs.html), the following characteristics were noted for the computer support position. An average salary of $44,973 was reported, with 49% feeling that those in the support positions are fairly compensated. The average bonus was about $2,100, with 50% receiving a bonus. Salary raises averaged 19%, with over 76% getting raises. The average work experience in IS was 8 years, and the average time spent with the current company was 4.5 years. While about 27% were high school graduates, the remainder of those reporting had completed at least an associate degree. Only 47% held some type of technology certification. Those surveyed reported that the three most important motivation factors were compensation, recognition from management and users, and working with cutting-edge technologies. Most support personnel worked about 43 hours per week. The two most noted web sites for data were the Help Desk Institute (www.helpdeskinst.com) and the Association of Support Professionals (www.asponline.com).

EUS COURSE

Researchers continue to identify IS skills necessary for successful IS graduates, and professional associations develop and modify model curricula. The IS model curricula, and thus IS degree programs associated with them, are oriented to the application development area in computing. Traditional systems development curricula prepare students to enter the job market as programmers with the skills necessary to develop, manage, and maintain IS or IT. In most development programs, the attention devoted to skills required to support the end-user computing environment is minimal or non-existent. Some of the necessary skills are tangential, in that students are expected to know content but are not taught the material in a formal classroom setting.

Lee, Trauth, and Farwell [9] suggest different career tracks will emerge within the IS field as the dynamics of business continue to alter the framework of organiza-tions and information technology. Their results also indicate that current IS curricula are inappropriately preparing students to meet the needs of business, and they suggest new IS curricula be developed to meet the needs of the various career tracks within the IS field. None of the reviewed curricula has a course specifically related to the EUS area. The closest situation is in the Organizational Systems Research Association (ORSA) material with parts of three courses related to this content. The three courses are end-user technology solutions (OEIS-2), organizational and end-user information systems planning and design (OEIS-3), and designing and managing organizational training (OEIS-5).

While no specific curriculum exists for EUS, courses dealing with associated topics can be found in various academic institutions plus within national Information Systems (IS) and ORSA curriculum studies. The ORSA curriculum (www.osra.org) is designed for organizational and end-user information systems and thus promotes research and application of information technology in the end-user environment. Their objective is to support work processes, improve employee performance, and enhance overall organizational effectiveness in direct support of end-user-oriented goals and strategies.

The course described in this paper is a junior level elective that has been developed to meet the specific needs for supporting end-user computing in today's dynamic business environment. The course focuses on the three functions of a Help Desk or Information Center (IC).

1. providing technical support on hardware and software applications,
2. training end-users in the use of hardware and software, and
3. assisting the organization in solving business problems.

The prerequisites associated with the course are the software course in MS Office, Visual BASIC programming, and the systems analysis content. These prerequisite courses provide a solid technical foundation from which to build. Most students have also taken a programming course in C++ and/or COBOL. During the course, students are expected to apply the knowledge and experiences gained in their previous courses.

Course Objectives

Students apply knowledge gained through work experience and previous coursework to develop the skills necessary to expand their knowledge base. The course objectives center on students being able to:

1. identify and understand the basic elements of support expectations from internal and external sources;
2. describe technological concepts and tools used to serve the organization's business needs, including management issues;
3. prepare and present training sessions for business application tools;
4. research and analyze end-user needs and provide appropriate solutions to meet those needs;
5. troubleshoot hardware and software associated with the microcomputer, including learning the skills necessary to function as a PC support or help desk technician;
6. research, access, and assess appropriate web resources dealing with various support tasks; and
7. evaluate products in a strategic setting for various business environments.

Course Material

When the course was first taught, no textbooks adequately covered the broad nature of EUS. While textbooks were available for applications, networks, operating systems, databases, training, and all of the other components, no one had developed a textbook specifically targeting EUS until Fred Beisse's book, *A Guide to Computer User Support* (Course Technology, 1999). A second edition of this book is now available. In the same manner, the new second edition of the O'Connor and Regan book, *End-User Information Systems* (Prentice-Hall, 2001), provides a synthesis of implementing individual and work group technologies within the EUS area.

To compensate for the initial lack of a textbook, the instructors utilized journal articles, web sites, videos, guest speakers, tours, outlines, and cases to cover course content. In addition, former students who are currently working in user support roles have returned to share their experiences and show how class and work environments relate. By using these instructional aids, the course maintains a level of currency not available using only textbooks.

Course Activities

To achieve the objectives of the class, several approaches are used. Learning activities include lectures, class discussions, hands-on experience, cases, student presentations, and outside application assignments. Each student participates in a group project that includes learning a business application software package and instructing class members in its use. This portion of the course requires installation and documentation of the selected software; preparation of a training plan, tutorial, and exercises for student completion as a set of task-based assignments; and conducting a training session for the software. The results of the project are presented by the group and must address issues concerning: the business problem addressed; choice, cost, capabilities, and use of the solution; resources required for training, implementation, and maintenance; and recommendations concerning the software chosen.

Another focus area concerns the student's interaction with end-users. Several options have been explored to satisfy this requirement. Classmates may recruit students to help in local business settings. Local public agencies and private firms often desire assistance in developing their own training presentations and can benefit from assistance. For example, a student developed a one-day training session on Microsoft PowerPoint for employees of a local branch of government. Those individuals who attended were preparing to train other employees in use of the tool. While this type of situation may result in financial remuneration, the experience gained from interacting with end-users is even more valuable. Students can provide a valuable service to the community while discovering how to effectively assist and train others in utilizing IS resources.

Other ways to achieve interaction with end-users are available on campus. Students may assist students in computer laboratories or campus users by working in an IT support department. Based on the university's need, the instructor develops a list of positions available. Students then select their preferred venue for help sessions. A few students are chosen to work at the university's help desk. One group of students developed a five-page tutorial on using Microsoft Visio for use by other students, faculty, and professional staff. Other students may be given a business problem and asked to develop prototypes of screens for implementation in Visual Basic. While support personnel are not typically considered programmers, they must understand the basic concepts of programming, including structured or modular coding or object-oriented programming.

To develop their understanding of user issues with hardware, software, and networks, students work through hands-on computer projects. Older/replacement machines are brought into a computer laboratory. These machines are not screened beforehand, and hardware components may need to be replaced. In one situation, a student team went through four machines before their device was operational for projects. While the focus is on hardware down to the bare box level, many software packages are examined to enhance the troubleshooting and maintenance aspects in a "closed box environment. Common operating systems (MS-DOS, Microsoft Windows variations, and Linux) are installed, and basic tasks are completed. Additional work is done for the CMOS, IRQ, and DMA settings.

A laboratory manual is used for the hands-on aspect of the course. While the projects are attempted more in a "closed box mode, the course allows hardware examination via the "open the box mode. Among seven books dealing with laboratory exercises [see Appendix B], Clint Saxton's *Enhanced Manual for Managing and Maintaining Your Computer*, 3d ed. (Course Technology, 2001) was considered best for the course environment. Additional references concerning hardware support can be found in Appendix A.

CONCERNS AND FUTURE IMPLICATIONS

The skills associated with EUS are changing. Some technical skills, such as MS-DOS command level expertise, are disappearing due to the ubiquitous graphical user interface. For instance, operating systems and software packages rely less on the skills associated with system-level configuration of devices. Plug-and-play features take the hands-on skills away from the technician. The "old command level skills need to be included in the academic environment; otherwise, the basic skills will be lost for newer support personnel. "Old software, hardware, and operating systems are still in place and must be maintained. Interfaces between "old and current systems are necessary. Without command level skills, these tasks cannot be accomplished.

Due to early exposure to PCs and the Internet, computer literacy among entering college students should be improving. Our experience indicates that Internet surfing, web page design, and e-mail skills are fine. However, in a rolling survey of over 700 students over the last three years, we find that students did not possess the skills required for tasks such as formatting disks, creating and moving folders, copying files from diskette to diskette, and saving screen captures to files. This same set of skills was similarly weak for 200 graduate students at various stages of coursework in both computing and business programs. EUS must provide the technical support, training, and assistance needed to allow these future organization members to effectively perform their jobs.

Student feedback from this elective course is starting to re-shape the content. Comments concerning the hardware portion of the material have been very positive. However, graduates report that hands-on repair tasks are used more for personal machines than on-the-job. Their job-related hardware tasks have focused on swapping drives (floppy and CDROM) plus installing larger hard drives with the second drive becoming a slave (normally a swapping issue for the PC used as a stand-alone device). The other technical materials, while informative, have been used very little on the job.

While certification is not an expected result for students, the success rate has been very good for alumni. Of the 120 students who completed the course in the last two years, approximately 35 students have started their computing career in the support field. Twenty of those have attempted some type of certification (e.g., Microsoft, Novell, or CompTIA). Ninety percent of those attempting certification have passed the certification test on their first attempt.

SUMMARY

As the IS/IT field continues to expand, academic programs cannot prepare students to be proficient in all areas. We as academic IS professionals must prepare the general professional with some specializations. Fortunately, the specialized programs needed are beginning to emerge in IS programs. EUS specialists must be prepared to provide technical support, train end-users, and assist in solving business problems.

Courses in EUS are an innovative approach to preparing IS professionals to support end-users. Fifteen different but similar approaches to teaching EUS were examined as the foundation for a new, specialized course. Input from these approaches provided a framework for this course designed to prepare students who plan to enter the job market as EUS specialists. While this class offers a great beginning, much work needs to be completed. Continued efforts will enhance this course and help develop new courses to meet the diverse needs of this new specialized area within IS.

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APPENDIX A
GENERAL HARDWARE SUPPORT

Most of the books listed include at least one CD-ROM with sample questions, video clips, software, and other references. The following list of materials seems to have had a positive influence on teaching the class.

1. Andrews, J. *A Guide to Managing and Maintaining Your PC.* Cambridge, MA: Course Technology, 2000, 1165 pages, ISBN: 0-619-00038-4.

2. Chase, K. *The IRQ Book.* New York: The McGraw-Hill Book Company, 1999. 324 pages, ISBN: 0-07-134698-8.

3. Johnson, D. and Stauffer, T. *Upgrading and Repairing Your PC: ANSWERS, Certified Tech Support.* Berkeley, CA: Osborne/McGraw-Hill, 1998, 496 pages, ISBN: 0-07-882463-X.

4. Lee, A. *Building Your Own PC: Buying and Assembling with Confidence.* Grand Rapids, MI: Abacus Software, Inc., 1998, 117 pages, ISBN: 1-55755-320-3.

5. Meyer, M. *A+ Certification Guide.* New York: McGraw-Hill Book Company, 2000, 966 pages, ISBN: 0-07-212266-8.

6. Minasi, M. *The Complete PC Upgrade and Maintenance Guide*, 9th ed. Alameda, CA: SYBEX, 1998, 1607 pages, ISBN: 0-7821-2357-0.

7. Mueller, S. *Upgrading and Repairing PCs*, 11th ed. Indianapolis, IN: Que Publishing, 1998, 168 pages, ISBN: 0-7897-903-7.

8. Olsen, M. [project manager]. *Sourcebook for the Help Desk*, 2d ed. Redmond, WA: Microsoft Press, 1997, 477 pages.

9. Rosch, W. L. *Hardware Bible*, 5th ed. Indianapolis, IN: Que Publishing, 1999, 1415 pages, ISBN: 0-7897-1743-3.

APPENDIX B
HANDS-ON LABORATORY MANUALS

1. Antonakos, J. and Adamson, T. *Microcomputer Repair*, 3d ed. Upper Saddle River, New Jersey: Prentice-Hall, 1999, 693 pages, ISBN: 0-13-893454-1.

2. Beeson, D. *Assembling and Repairing Personal Computers*, 2nd ed. Upper Saddle River, New Jersey: Prentice-Hall, 2000, 458 pages, ISBN: 0-13-081949-2.

3. Evans, D. *A+ Complete Lab Manual.* Alameda, CA: SYBEX, Inc., 1999, 232 pages, ISBN: 0-7821-2591-3.

4. Mansfield, R. and Petroutsos, E. *The PC Upgrade and Maintenance Lab Manual*, Alameda, CA: SYBEX, Inc., 2000, 279 pages, ISBN: 0-7821-2707-X.

5. Regan, P. *Troubleshooting the PC.* Upper Saddle River, New Jersey: Prentice-Hall, 2000, 655 pages, ISBN: 0-13-095796-8.

6. Saxton, C. *Enhanced Manual for Managing and Maintaining Your Computer*, 3d ed. Boston, MA: Course Technology, 2001, 344 pages, ISBN: 0-619-03435-1.

7. Schmidt, C. *The Complete Computer Repair Textbook*, 2nd ed. El Granada, CA: Scott/Jones Inc, Publishers, 2000, 745 pages, ISBN: 1-57676-033-2.

TEACHING THE EVALUATION OF ELECTRONIC COMMERCE SITES USING HCI TECHNIQUES

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ABSTRACT

According to Dix et al., [1998] human-computer interaction (HCI) involves the design, implementation and evaluation of interactive systems in the context of the user's task and work. This paper will focus on the HCI evaluation techniques used in the design and implementation of interactive systems with the emphasis on electronic commerce sites. Electronic commerce is according to Turban et al., [1999] the process of buying and selling or exchanging of products, services and information via computer networks, which includes the Internet. Books on electronic commerce seldom, if ever focus on the evaluation of web sites [Turban et al., 1999; Kalakota & Whinston, 1996; Dahl & Lesnick, 1996]. The fundamental question that needs answering is whether we can apply the existing HCI evaluation techniques to evaluate electronic commerce sites or do we need more than that or totally different techniques. Existing evaluation techniques that will be discussed with a view of applying them to evaluate electronic commerce sites are cognitive walkthroughs, heuristic evaluation, review-based evaluation, model-based evaluation, observational techniques and usability testing. In order to answer the question the paper will apply some of these HCI evaluation techniques to a number of South African electronic commerce sites. Proposals for the extension of these techniques to make them more applicable for electronic commerce, as well as the possibility of new evaluation techniques, will be discussed.

INTRODUCTION

The importance of evaluation in HCI design is mentioned by several authors of HCI books [Dix et al., 1998; Preece, 1994; Schneidermann, 1992]. Preece [1994:601] says that "*Without doing some form of evaluation it is impossible to know whether or not the design or system fulfils the needs of the users and how well it fits the physical, social and organizational context in which it will be used.*" In the electronic commerce field, especially in business-to-consumer commerce, it is essential to evaluate the success of the business on the web. If one, however, consult books written on electronic commerce there is a lack of discussion or mostly no discussion at all on the evaluation of electronic commerce sites [Turban et al., 1999; Whiteley, 2000; Kalakota & Whinston, 1996; Dahl & Lesnick, 1996].

This paper discusses the use of HCI evaluation techniques in an electronic commerce postgraduate class as a tool to teach the students how to evaluate business-to-consumer sites. The application of the various students of these methods to different South African web sites will be described. All sites were developed by leading South African web development companies as listed in Intelligence, a monthly computer magazine published in South Africa. The problems that came forward using HCI techniques will be highlighted and possible solutions and further research will be mentioned. The first part of the paper sets the scene by describing what is understood by electronic commerce and HCI evaluation.

DEFINING ELECTRONIC COMMERCE

Turban et al., [1999:4] describes electronic commerce as "*an emerging concept that describes the process of buying and selling or exchanging of products, services and information via computer networks including the Internet.*" Some people use the concept of electronic business and then refers to a broader definition of electronic commerce, which includes servicing customers, collaborating with business partners and conducting electronic transactions within an organisation. Electronic commerce will be used in this paper in its broadest sense. We normally classify electronic commerce by the nature of the transactions that can be business-to-business, business-to-consumer and intra-business or organisational electronic commerce. The focus of the evaluations done for this study is on business-to-consumer electronic commerce, which involves retailing transactions with individual shoppers and was done on the final web site that was published by the particular company and not during the design phase.

HCI EVALUATION TECHNIQUES

Defining Evaluation

Preece [1994:602] defines evaluation as follows:

> Evaluation is concerned with gathering data about the usability of a design or product by a specified group of users for a particular activity within a specified environment or work context.

Why do we want to do evaluation? The answer to this question is normally to find out what the users want and what problems they experience. Without evaluation the system that reaches the consumer will be untried and only reflect the ideas of the design team with no relationship between design and use [Preece, 1994].

During evaluation it is important to consider the characteristics of the users of the system, the types of activities the users will do and the nature of the product (prototype or fully developed system) being evaluated. We normally distinguish between formative and summative evaluations. In this study a summative evaluation of a fully developed product was done.

According to Rubin [1988], there are three general objectives which can be identified in the evaluation of any user interface, irrespective of the type of interface, the hardware or software, the stage in the design, the use or not of humans in the evaluation process, the method used and the type of data gathered. These objectives are:

- The assessment of the capabilities of the design against the requirements of the users.
- The assessment of the impacts of design decisions on the user and the user's interactions with the system.
- The diagnosis of problems with the design in an attempt to identify and clarify the scope of specific problems.

Review of HCI Evaluation Techniques

Several authors described different evaluation techniques [Preece, 1994; Dix et al., 1998, Schneiderman, 1992]. These include observing and monitoring usage, collecting user's opinions and surveys, experiments and benchmarking, interpretive evaluation, predictive evaluation, usability laboratories, field studies, cognitive walkhrough, heuristic evaluation, review-based evaluation, model-based evaluation, empirical methods, et cetera.

The following methods, based on the work of Dix et al., [1998] and Preece [1994] were discussed with the students in the Electronic Commerce class.

Cognitive walkthrough. During the cognitive walkthrough the evaluator step through the actions required by the user interface to check for possible usability problems. The walkthrough requires four things: a description of the system, a description of the task that the user must perform, a list of the actions needed to complete the task and a description of who the users are.

Heuristic evaluation. This method was developed by Jakob Nielsen and Rolf Molich and concerns the use of a set of guidelines or general principles to critique a decision that has already been made. The list of heuristics includes: visibility of system status, match between system and real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help functions, and help users recognise, diagnose and recover from errors.

Review-based evaluation. In review-based evaluation, a study of literature for evidence to support or refute the different aspects of the design is done. According to Dix et al., [1998] "*the review should take into account similarities and differences between the experimental context and the design under consideration*."

Model-based evaluation. Certain cognitive and design models provide a means to evaluate, for example, the GOMS model, keystroke model (at a low level) and the design methodology - design rationale - which provides a framework in which design options can be evaluated.

Empirical methods. Although the use of an experiment is a powerful tool for evaluating design, only the basic principles were discussed with the students due to the lack of statistical background of some of the students. In this method the evaluator chooses a hypothesis to test, using certain subjects and variables.

Observational techniques. Think aloud, protocol analysis and post-task walkthroughs were discussed.

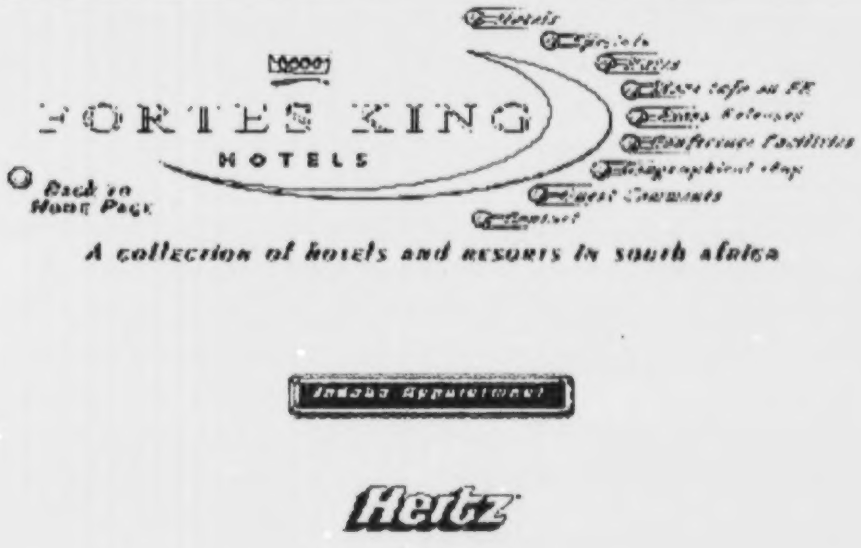
Query techniques. Two main types of query techniques were mentioned, namely interviews and questionnaires

Usability testing. The usability principles from HCI, namely learnability, flexibility and robustness [Preece, 1994, Dix et al., 1998] were discussed with the students. Considering usability from a web site perspective: According to Keith Instone (http://usableweb.com/instone) you need to follow five steps and then watch people carefully as they try to use your site. The steps are: Know your purpose with the site, find ordinary users, watch and learn, collect the data and go back to the drawing board.

During the lecture on evaluation techniques Jakob Nielsen's top ten mistakes in web design (http://www.useit.com) was also mentioned as well as the principles of good digital store design as described by Dahl & Lesnick [1996].

APPLICATIONS OF HCI TECHNIQUES TO A NUMBER OF SOUTH AFRICAN ELECTRONIC COMMERCE WEB SITES

Students in the fourth year (honours) Informatics course on electronic commerce were given the assignment to evaluate different web sites where business-to-consumer transactions take place. They had to choose at least one of the evaluation methods discussed in class. In total, seven different sites were given to them, divided equally amongst the students. All of these sites were outsourced to South African web development companies and not developed in-house in the company. Only three of the sites evaluated will be described in this paper, namely the site of Fortes King Hotels, AA Auto finance and Cellular Shop. The students' background on HCI evaluation techniques were information given to them in a two-hour lecture and study material handed out in class. They have had extensive exposure to interface design, both in the undergraduate studies and in the design of web sites during the electronic commerce course.



Fortes King Hotels

(http://www.fortesking-hotels.co.za)

Fortes King is a South African company that manages 11 hotels in the Western Cape Province. On the site, the user can browse through a list of hotels, see what the hotels look like and make holiday or conference reservations. The main objective of the site is to advertise and sell their services. The target users are people who want to go on holiday or seek a conference location.

Evaluation of this site was done using an evaluation score sheet as described in the conclusion, cognitive walkthroughs, heuristic evaluation, think-aloud observational techniques, usability testing and post-test interviews. The summarised impression of the 9 student evaluators is given in Table 1.

TABLE 1
FORTES-KING HOTELS

Evaluator	Methods used	Impression
1	Evaluation score sheet Cognitive walkthroughs Think-aloud observation Post-test interviews	An average site with no serious errors, but rather dull. No entertainment, specials or new features that would prompt the customer to return to the site.
2	Heuristic evaluation Usability testing	Design is simple and clear and looks professional but rather clinical and boring. No entertainment and is purely an information provider. Inconsistent in some places and there is room for improvement.
3	Heuristic evaluation	The site is easy to use, understand and navigate. Includes the correct amount of information. The use of images is done very effectively.
4	Review-based evaluation	The site has a professional appearance, easy to navigate and use, includes all the necessary information.
5	Usability testing	The site can do with a lot of improvement: It does not add any information that could not be included in a brochure or given over the phone. It does not give Fortes-King a competitive edge.
6	Cognitive walkthroughs Heuristic evaluation	The web site provided enough information to satisfy customer needs at a high level, screens effectively displays the company profile, but more advertising and less boring screens could be used.
7	Review-based evaluation	Site is properly designed, maintained and developed.
8	Heuristic evaluation	Content and context offered are very effective in providing the necessary information and means to enable customers to interact. More effort can be made to entertain visitors and rewarding of loyal customers. A very good web site.
9	Heuristic evaluation Use of Netmechanic	Content of the site is sufficient but site navigation is difficult, much more can be provided on the site to expand their business.

AA Auto Finance

(http://www.aaaf.co.za)

FINANCE
products & services
Products & Services
Financing
Contact Us
Applications
Back
Find

The AA Auto finance web site is aimed at the prospective vehicle buyer and gives a customer the opportunity to apply for vehicle financing online. It also aims to inform potential customers of services offered and to offer the initial stage of those services online. Eleven students evaluated this site and all of them chose to do a heuristic evaluation of the site. Their impressions of the site are summarised in Table 2.

Cellular Shop

(http://www.cellshop.co.za)

The Cellular Shop is the only independent specialist retailer authorised to offer all network products from the two official cellular service providers Vodacom and MTN. They specialise in providing unbiased advice about communication requirements and the selling of cellular phone, satellite phones, PDAs and cell phone accessories online with free delivery of you purchase to your doorstep. The site has both a normal and a flash version.

Ten students evaluated this web site and their impressions are summarised in Table 3.

THE CELLULAR SHOP
Register

Do you want to shop online, get great specials, and enter our competition? Then register with us

TABLE 2
AA AUTO FINANCE

Evaluator	Impressions
1	The site is relatively well-designed, but includes some of the top ten design mistakes [Jakob Nielsen]. At first glance the site seems cluttered.
2	The site is a pleasing and informative web site with all the basic information that is needed. Some minor design errors were encountered.
3	The site is aesthetically pleasing, but lack on the content side.
4	The site is technologically intensive and has an easy to use interface. The testing shows very positive results with easy access to information. Downloading time may be a problem.
5	The overall impression is very good, except for slow response times. Layout was done very well.
6	Use of colours on the site is not working, eg white on yellow. A number of errors were picked up, eg links that are not working, orphan pages. Overall impression is good and the use of graphics effective.
7	It is a good site in terms of simplicity, provision of feedback and short loading time. There are erroneous links, empty pages and misleading heading links.
8	This student used a rating sheet for the different heuristics and came up with 62% for content and 73% for design. His overall impression was good although some errors were reported.
9	This student also used a point system and awarded the site with a mark of 20 out of a possible 40 marks. His final comment: "It takes more than a pretty face to create successful web business
10	Too many mistakes and oversights make this a fairly average to poor web site, due to an overall lack of content and interactivity.
11	Positive: no long scrolling pages and overly long download times. Negative: links are not working and use of colour.

TABLE 3
CELLULAR SHOP

Evaluator	Methods used	Impression
1	Usability testing Heuristic evaluation	It has an overall good design with a few problems. Pages are easy to access, navigation is well-designed, no broken links or orphan pages. Users are encouraged to return with news and links pages.
2	Heuristic evaluation Review-based evaluation	Site is quite good but people will probably use it only to collect information before going to a traditional store. Added services like choosing your phone and contract on the web is necessary.
3	Heuristic evaluation	The site performs satisfactory with respect to consistency and aesthetic and minimalist design. Some information is outdated and there are some orphan pages.
4	Heuristic evaluation	No proper design was carried out before the implementation. The site is not impressive at all and there are lots of common mistakes that web designers make.
5	Heuristic evaluation Usability testing	Overall impression was that the site is aesthetically pleasing and functional. The content is relevant and useful, it is easy to learn and is entertaining and interesting. An excellent site.
6	Usability testing	The student used a scale to rate the site and came up with a average value of 4.2 on a scale of 1 (not acceptable) to 5 (excellent).
7	Heuristic evaluation	There are interesting links which make this more than just a site selling things. It is a good site which can be awarded if they clear up some minor mistakes.
8	Cognitive walkthrough Heuristic evaluation Review-based evaluation	The site is functional and easy to use. The student rated the site as 7 / 10.
9	Heuristic evaluation Usability testing	The site reaches the goals of the company, which is providing a professional image. The site is successful, scoring high on basic design principles and provides a functional and effective digital storefront.
10	Heuristic evaluation	On the whole a good web site with lots of information, but there are minor problems that should be solved to improve the company's image.

CONCLUDING REMARKS ON THE EVALUATION

Judging from the different responses from the students, who are not experienced evaluators but knowledgable in electronic commerce and have at the stage when they did this assignment already completed the development of their own electronic commerce site, the evaluation process was not entirely successful. Most students chose to use the heuristic evaluation, which was probably the easy way out. They did not, however, use the same set of guidelines. Many of the students used the top ten mistakes mentioned by Jakob Nielsen on his site http://www.useit.com as a set of guidelines. Others used the set of heuristics mentioned by Dix et al., [1998], while there were also students who used the design principles of a digital storefront described by Dahl & Lesnick [1996] and any guidelines they could get on the web describing good web design in general. The use of these different sets of guidelines probably resulted in the difference of opinion about the three sites evaluated. As could be expected, students who used more than one evaluation method came up with far better results and a more complete evaluation than those who used only one method.

IMPLICATIONS FOR THE TEACHING OF EVALUATION TECHNIQUES FOR ELECTRONIC COMMERCE SITES

From the results of the evaluation it was clear to the author and lecturer that a two hour lecture on evaluation methods was not good enough to get valuable results from the students. We still feel that it is a good way to teach evaluation of electronic commerce websites, but that more time need to be spent on the subject in class. The development of a specific set of usability metrics for electronic commerce sites is also recommended. It is important that we do teach the students to do evaluation of their sites as this is a neglected part of electronic commerce teaching. In the course that we are currently teaching we have changed the course to include more time spent on HCI evaluation techniques. The students are also instructed to evaluate their own websites that they are designing, during the design phase and after completion of the site. These evaluations must be done using at least two evaluation techniques and must involve users of the electronic commerce site and not only the students. As this course is still running to the end of November 2001, the author will be able to report at the conference on the results.

CONCLUSION

Software exists on the web that allows you to test your web site. Most of those packages and guidelines are general and not developed specifically for electronic commerce business-to-consumer sites. One such package is on the web site garage site (http://websitegarage.netscape.com). National Chamberweb also allows you to form an idea of the quality of your site (http://www.chamberweb.com/evaluate) and concentrate more on electronic commerce type of applications. This evaluation tool considers the following sections:

- Findability, where the site is rated on whether the right actions are taken to build traffic. One such action will be have the URL on all printed material and promote the site in advertisements, events and conversations. The site must also be registered with the main search engines such as Yahoo, LookSmart, Snap! and others. External links to your site must exist.

- Relevance and features, which evaluates relevant content, member directory, two-way communication (eg electronic mail) and special features such as calendars, chat rooms, et cetera.

- Usability, covers a number of criteria including fast loading, text tags on graphics, visible navigation choices, compatibility with common browsers and navigation aids.

- The company's objectives with the site are also evaluated and can include an increase in revenue, decrease in expenses and an enhancement of the existing features of the company.

The following are features that need evaluation, but they are still relevant to all types of web sites and not necessarily electronic commerce sites.

- Broken Links—a number of software packages are available to check the existence of broken links and construction pages such as InfoLink Link Checker 1.9 (http://www.biggbyte.com/download/html).

- Testing of contact information and reply time—what is the turnaround time for queries and the quality of the answers?

- Updates and maintenance—last date updated should be given and information should be recent and relevant.

- Competition's sites—a look at the main competitors may give you an idea of the standard of your site.

Srivihok [2000] explains in his article that the evaluation of electronic commerce is critical for the success of future systems. He developed a tool based on the task-technology fit model, which focuses on user evaluation of information systems. Srivihok proposes that more systematic techniques are needed to measure user evaluation of electronic commerce web sites. In his methodology he uses he used confirmatory methods to develop a hypothesised model to randomly collect data from electronic commerce users surfing the Internet. In the second step he uses exploratory methods to empirically evaluate the data and thirdly confirmatory methods will be used to test the hypothesised model against new data collected. This is, however, still research in progress and is not necessarily that different from the use of empirical methods in HCI evaluation.

From traditional literature, conference proceedings and publications on the web, it seems as if the focus stays on what is good web site design and what constitutes a usable web site. The evaluation of electronic commerce web sites seems to be considered of less importance. In a paper by Tilson et al., where they evaluated four e-commerce sites, they discovered that there are a number of new issues, but that these issues can still be understood within the context of traditional HCI principles. More research needs to be done on how we can use the HCI evaluation techniques, enhance them to make them usable for the evaluation of electronic commerce web sites. At the moment it seems as if electronic commerce developers think that if they teach good web design, no evaluation is necessary!

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A SURVEY OF DATABASE CURRICULA USING WEB-POSTED SYLLABI

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ABSTRACT

A review of syllabi available on the World Wide Web has been conducted to illustrate topics of universal interest, modest interest, or very little interest among academics. Some topics, such as the use of Entity-Relationship modeling were almost universally covered in these courses. Emerging topics such as Data Visualization and Multimedia DBMS had almost no coverage in the syllabi studied. Web interfaces, a topic which would be expected to have wide interest, had only modest coverage. The full results of this study should be of interest to all higher education faculty teaching an introductory database class. Some recommendations are made based on emerging trends identified in the literature of this study.

INTRODUCTION

Survey studies of Information Systems specialty areas have been instructive in identifying developments and trends at the course level as well as the program level (Sendall, 1999, O'Hara, 2000). In order for IS faculty to best serve student and employer constituencies, sharing information about topical coverage, pedagogy, and emerging issues is critical. Few other fields have such rapid turnover in current content and richness of sources of knowledge.

This study focuses on the undergraduate database course. Coverage of Database Issues has been identified and confirmed as an important part of a comprehensive IS Curriculum (Couger, et al, 1995, Longenecker and Feinstein, 1999). No single area in IS has such universal application across organization types and organizational levels (McFadden, Hoffer, and Prescott, 1999, Rindegard, 1999). Emerging topics such as Object Databases (Sgarioto, 1999) and Data Mining (Whiting, 2000) pressure database curricula in universities to keep pace with industry. Identifying commonalities and trends in undergraduate database courses will expand on these important foundational curriculum studies.

Integration of databases and web applications is a subject of high industry interest as a key component of Electronic Commerce (Morrison and Morrison, 2000). Most modern database products such as Access and Oracle 8i have web development features built in. Some database texts have a focus on web pages as the primary user interface (Riccardi, 2001). Whether academia is keeping up with this apparent mandate will be of interest in the current study.

This survey is descriptive in purpose. A broad survey of syllabi (mostly from Spring 2001) will establish a general model of coverage across most institution types and locations. It will also serve as a cornerstone for future research of a normative nature that would include information surveyed from employers about what topics are important and useful for persons entering the job market to know.

METHODOLOGY

The methodology for the study is a content analysis of on-line syllabi for database classes in four-year institutions. An initial list of syllabi was located using a web search tool with the words "database" and syllabus." This search yielded over one hundred locations. Universities from the United States as well as other countries are included. An initial convenience sample of ten syllabi was analyzed to list the relevant content items that would be recorded in the larger study. Twenty-seven items were identified.

The investigator followed promising links in order to find syllabi that were deemed appropriate for the study. The study was limited to four-year institutions offering Bachelor's degrees and above. Where schools of business were clearly separate from computing science programs, the database course from the business curriculum were used. In a few cases, a "CS" course syllabus was used due to the absence of Information Technology programs or courses within the Business School. Most syllabi are from undergraduate courses. Some (usually identified by a course number of 500 or above) were from Master's in Business programs. In these cases, it was clear that the course was intended for MBA students who had no prior course in database principles.

Extensive searching of the list of links, and further searches to expand the list, yielded 50 online syllabi. The syllabi were printed to facilitate analysis. Each syllabus was carefully studied, with the presence or absence of each of the 27 content elements of interest being recorded for all sample points. The content element had to be explicitly stated or clearly implied in order to be counted as present. Results were kept in an Access database. The database also recorded whether the institution was public private, and the country the institution was located in. Totals and subtotals were computed using Access queries.

RESULTS

Final results of the content analysis of all 50 database syllabi were consistent in proportion of presence of content elements with the pre-test of 10 syllabi. The pre-test summary is given in Table 1.

These preliminary results suggested that many 'current' database topics were receiving little coverage in university curricula. It was determined that this was an adequate list of content elements, even though it was likely that some syllabi in the final sample might include elements not listed here. The ten institutions used to ascertain this list were not shown above, as they are part of the total sample shown in Table 2.

The twenty seven content elements and their frequencies for the full sample are given in Table 3.

DISCUSSION

Some interesting findings are evident in Table 3. As might be expected, topics such as ERD's and the Relational model receive universal coverage. The most popular platform for official sanction by a course (where this is a preferred package) is MS Access, with Oracle in second place. Object Oriented modeling, web integration, and SQL are covered about half the time. Surprisingly, several topics, which were strongly stated to be important in the literature review, receive little coverage. For example, only about a fourth of the courses studied include Data Warehousing. Many topics identified in a widely recognized IS Curriculum study (Couger et al., 1995) receive far below full coverage. Examples are: Object Oriented Modeling (52%), Multimedia (8%), and structured development methodologies (60%).

Comparisons of public *vs* private institutions, and US *vs* non-US institutions yielded some interesting observations. Most topics were covered equally across these divisions. However, there were a few distinct differences. For example, 64% of public institutions covered distributed databases, while only 36% of the private ones did. Generally, public institutions covered more topics than private ones. Non-US institutions were far more interested in Client-Server technology and Middleware than their US counterparts (75% to32%). US Institutions were slightly more likely to cover security issues (66% to 50%) and Database Administration (71% to 50%) than non US ones.

IMPLICATIONS AND LIMITATIONS

The most significant of these findings was the low occurrence of coverage of important topics, as identified by industry and academic literature. Faculty teaching database classes should be interested in the overall results of this study, either as a validation of what they are already doing, or a mandate to expand topical coverage in their courses.

A further benefit of this study is to stimulate further research into appropriate content of database curricula either by grounding in prior studies or collecting fresh primary data from industry and academia. While the current study was mostly descriptive, further research

TABLE 1
RESULTS OF PRELIMINARY ANALYSIS TO DETERMINE LIST OF CONTENT ELEMENTS

Topic	Institution Number									
	1	2	3	4	5	6	7	8	9	10
Intro to Database Topics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intro to Relational Model	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Non-Relational DB Architectures	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
Conceptual Modeling (ERD)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Normalization	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Physical Design / Performance	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No
Relational Algebra / QBE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Object Oriented Modeling	Yes	Yes	No	No	No	No	No	Yes	Yes	No
System Development Issues	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Data Flow Diagrams	Yes	No	No	No	No	No	No	No	No	No
Applied MS Access	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No
Applied ORACLE	Yes	No	No	No	No	No	No	Yes	No	No
Transaction Processing	Yes	No	Yes	No	No	No	No	No	Yes	No
Overview of Distributed. Databases	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Concurrency Control	Yes	No	Yes	No	No	No	No	Yes	Yes	No
Client-Server / Middleware	No	No	Yes	Yes	No	Yes	No	Yes	No	No
SQL Overview	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Applied SQL	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No
Security Data Integrity	Yes	No	Yes	Yes	No	No	No	No	Yes	No
Database Administration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Warehousing	No	Yes	Yes	No	No	Yes	No	Yes	No	No
Data Mining/Knowledge Discovery	No	No	Yes	Yes	No	Yes	No	No	No	No
Integrating Data with Web Applications	No	No	No	Yes	No	No	No	No	No	No
Data Visualization	No	No	Yes	Yes	Yes	No	No	No	No	No
Text Based DBMS	No	No	No	Yes	No	No	No	No	No	No
Interface Design Issues	No	No	No	No	No	Yes	No	No	No	No
Multimedia DBMS	No	No	No	No	No	Yes	No	No	No	No

TABLE 2
FULL SAMPLE OF DATABASE SYLLABI, WITH PROPORTION OF COVERAGE

Case	Course ID	Course Name	Funding	Country
1	DS 354	Database Management	Public	USA
2	BA 561	Database Management	Public	USA
3	MIS 420	Database Management	Public	USA
4	LS458	Database Management	Private	Canada
5	COMP 5790	Database Management	Private	USA
6	LSC 740	Database Management	Public	Sri Lanka
7	INFSCI 1022	Database Management Systems	Public	USA
8	COMP 380	Database Management Systems	Private	USA
9	CS 352	Database Systems	Private	USA
10	CMS 460	Database Design	Private	USA
11	CMPUT 291	File and Database Management Systems	Public	Canada
12	CIS 550	Database and Information Systems	Public	USA
13	61004	Database Systems	Public	China
14	DISC 7374	Advanced Database Management Systems	Public	USA
15	950-770	Advanced Database Design and Management	Public	USA

Table 2
(continued)

Case	Course ID	Course Name	Funding	Country
16	ISMT 226	Database Design and Administration	Public	China
17	COMP 378	Introduction to Database Management	Public	Canada
18	IST 213	Advanced Topics in Data Management	Public	USA
19	DBS-M	Databases	Public	UK
20	IDS 410	Business Computer Technology	Public	USA
21	ISDS 473	Database Management	Public	USA
22	ACCT & MIS 837	Management of Corporate Data Resources	Public	USA
23	FMDS 421	Business Database Development	Public	USA
24	MIS 325	Introduction to Data Management	Public	USA
25	B20.3335	Advanced Database Management	Public	USA
26	IS 321	Principles of Database Management	Public	USA
27	MBA 780S	Database Management	Private	USA
28	FMIS 3421	Database Management and Design	Public	USA
29	MIS 114	Database Management Systems for Business	Public	USA
30	6K-282	Applied Database Management Systems	Public	USA
31	ISM 4212	Information for Operating Control and Data Mgt.	Public	USA
32	MIS 484	Database Management Systems	Public	USA
33	MI 210	Database Management Systems	Public	India
34	LIS 5782	Database Management Systems	Public	USA
35	MGT 245	Database Management for Information Systems	Public	USA
36	MSC 3936	Database Management Systems	Private	USA
37	CIS 8410	Database Management Systems	Public	USA
38	MSIS 4013	Database Management	Public	USA
39	CMPT 354	Database Systems and Structures	Private	Canada
40	01528-0130	Database Management Systems w/CASE Tools	Private	USA
41	CPT 272	Database Programming	Public	USA
42	COM 3315	Principles of Database Systems	Public	USA
43	CSIS 3310	Database Systems	Public	USA
44	91.573	Database Management	Public	USA
45	INFS 3050	Database Design and Inquiry	Public	USA
46	COSC 4411	Database Management Systems	Public	Canada
47	INSS 651	Data Base Management Systems	Public	USA
48	CSM 204	Data Management Concepts	Private	USA
49	CSE 2132	Database Systems	Private	Australia
50	52-355	Databases	Public	Scotland

with more solid evidence of need could be more normative in nature.

Some significant limitations of the study are the convenience sample and the use of posted syllabi as a surrogate for more official content listings. No doubt, some of the courses covered topics that did not appear on the syllabi. Still, presence of a content element on the course syllabus is a good surrogate for degree of perceived importance to the faculty member, and hence the emphasis it will probably be given in class.

TABLE 3
CONTENT ELEMENT FREQUENCIES FOR FULL SAMPLE

Topic	Total Found	% of Sample	% of Private	% of Public	% of US	% of Non-US
Intro to Database Topics	50	100	100	100	100	100
Intro to Relational Model	49	98	100	97	97	100
Non-Relational DB Architectures	26	52	55	51	50	58
Conceptual Modeling (ERD)	50	100	100	100	100	100
Normalization	43	86	82	87	84	92
Physical Design / Performance	37	74	64	77	74	75
Relational Algebra / QBE	38	76	73	77	74	83
Object Oriented Modeling	26	52	45	54	55	42
System Development Issues	30	60	55	62	63	50
Data Flow Diagrams	3	6	0	8	8	0
Applied MS Access	24	48	36	51	53	33
Applied ORACLE	13	26	9	31	26	25
Transaction Processing	19	38	9	46	34	50
Overview of Distributed. Databases	29	58	36	64	58	58
Concurrency Control	19	38	27	41	37	42
Client-Server / Middleware	21	42	27	46	32	75
SQL Overview	44	88	91	87	87	92
Applied SQL	33	66	55	69	66	67
Security Data Integrity	31	62	55	64	66	50
Database Administration	33	66	73	64	71	50
Data Warehousing	14	28	9	33	29	25
Data Mining / Knowledge Discovery	8	16	9	18	13	25
Integrating Data with Web	14	28	36	26	29	25
Data Visualization	4	8	9	8	5	17
Text Based DBMS	8	16	18	15	13	25
Interface Design Issues	2	4	0	3	5	0
Multimedia DBMS	4	8	0	10	5	17

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REQUIRING STUDENTS TO BRING COMPUTERS TO CAMPUS: ARE UNIVERSITIES ACHIEVING THEIR GOALS?

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ABSTRACT

According to data from the Campus Computing Project, an independent annual survey of colleges' information-technology plans, less than 10 percent of colleges and universities currently require students to have their own computers. ("Growing Number of Colleges...," 2000) However, as universities fight to secure a competitive advantage for both themselves and their graduates in the 21st century, more institutions will be joining the ranks of those currently placing a desktop or a laptop in the hands of each co-ed. The goal of this paper is to poll the current thoughts of universities that do have such a requirement in place, of universities that are considering adopting a policy requiring computers in the near future, and of universities that have chosen not to jump on this band wagon. This paper will explore the technology objectives of these universities and attempt to determine if these objectives are being met through universities' current computer ownership requirements.

INTRODUCTION

As the computer screen replaces the notebook, a growing number of universities, both private and public, are requiring that students either purchase or lease their own computers, adding at least $1000 per year to the average cost of college expenses (Port, 1999). For freshman at the University of North Carolina at Chapel Hill, the choice was whether or not to pay $2182 for a standard ThinkPad or $2924 for a model with expanded memory and a larger hard drive. On some campuses of the Polytechnic University in New York, students are paying $500 each semester to lease a laptop ("Growing Number of Colleges...," 2000).

Some schools are requiring the purchase of specific hardware and software. Others are supplying minimum computer configurations appropriate to different degree programs. (University of Florida: Student Computer Requirement's web site, 2001).

While the students may bear some of the financial burden, states are investing heavily to create a technology-enabled environment. In Massachusetts the Board of Higher Education approved a $123 million program that includes vouchers for low-income students and training, facilities, equipment, and academic programs ("Massachusetts Takes Step..., 2000). The plan unconditionally embraces technology at a time when educational specialists are still trying to ascertain how computer ownership impacts education. The Board of Higher Education deemed this to be a necessary step in ensuring graduates will have the technological skills to fill tens of thousands of business and high-tech job openings (Healy, 2000). However, this program has stalled for lack of funding and public support. The board had anticipated financing the program with state-issued bonds. The state IT division ruled against bond financing. Because computers rapidly become obsolete, monies will have to come out of general revenues. Events such as the evaporation of the state's surplus and the public's reaction to the cost have stalled the Board of Higher Education's plans (Olsen, 2001).

Benefits

All students will have the same academic advantage. Typically students who qualify for financial aid are less likely to have the means to purchase computers. If technology is a university requirement, the cost can be factored into financial aid packages. Some universities are using special endowments or have redirected some revenue monies to help students meet these costs ("Growing Number of Colleges...," 2000).

The network and communications that these computers provide can improve faculty/student communications. Skills acquired while using the computers would provide real skills which would make graduates more marketable (Graf, 2000). Software could be obtained at reduced prices with a campus site license (Gates, 1998).

Courses offered in all majors will be able to incorporate the use of technology (University of Denver: 2001 Laptop Specifications web site, 2001). On some campuses, freshman are required to attend training sessions so that they will be able to use and configure the computers and will be prepared for class work and/or assignments (Lawrence, 1999).

In the case of wireless LAN technology, students can access a course material or e-mail faculty while sitting on a bench outside the library. Many believe that the greatest benefit of requiring computers comes from outside the classroom, where students have 24-7 access to campus network and the Internet (Olsen, 2001) Technology has elbowed its way out of computer labs. Universities can reclaim scarce physical space that once housed these labs. No more spending of endless dollars to rewire old building with asbestos ceilings and cinder block walls to meet changing technology needs. At Wake Forest this year, freshman received a wireless Ethernet card with their PC notebook, and a bill with their tuition statement. Approximately 11 percent of Carnegie Mellon's students purchased wireless LAN cards with which to access the university's wireless network (Brewin and Cope, 2000).

Faced with stagnant enrollment and low SAT scores, Western Carolina University implemented a plan to wire campus and require computers in 1995. Students may choose to purchase a desktop or a laptop. While enrollment has not climbed, the quality of the student has. SAT scores are on the rise as WCU emphasizes communications skills and critical thinking, not computer hardware (Johnson, 2000).

While most administrators agree that they are unable to measure the real impact of computer ownership on education, this policy will impact the institution's bottom line. Spending on information technology can be greatly reduced for the institution as these costs are passed on to the student (Olsen, 2001).

Concerns

Not everyone agrees that student ownership of computers is necessary. Everyone does agree that networks must be improved to accommodate increased traffic, the student's cost of education will rise, and both faculty and students will need additional training (Graf, 2000).

Security and battery life require thought and planning for universities that wish to embrace wireless technology (Brewin and Cope, 2000). Some faculty also worry about the integrity of using high-tech electronic devices in the classroom (Kobin, 2000).

Others are concerned about the added financial burden to students (Port, 1999). Chris Duckenfield, vice provost for computing and information technology at Clemson University, believes that it is unfair to require students to spend money on technology that will be obsolete in two years. In 33 labs across campus, Clemson has 800 computers available that can be configured to suit the user. Students do not have to invest in their own machine, they do not have to lug machines around, and equipment cannot be stolen ("Clemson Develops System," 1998).

Students at some universities that require computer ownership have been disappointed. The computer requirement brought with it the expectation that computers would be used in some, if not all, classes. In fact, few classes are computer intensive. Restructuring courses takes commitment and time for faculty members to create course content that is electronic (Olsen, 2001).

RESEARCH QUESTIONS

One goal of this paper was to survey universities with computer requirements and determine what their objectives were when these universities decided to embrace a technology requirement. The survey instrument then asked if these objectives are being met, and if not, why not. The instrument also asked the universities if they were experiencing any unexpected outcomes, good or bad, and if so what these outcomes are (i.e., change in enrollment or retention, etc.).

Another goal of this paper was to poll universities who have not begun requiring students to arrive on campus with computers in tow. Are they considering imposing a technology requirement? If so, what are the driving forces behind this decision? If not, why not?

A driver behind this project was the strategic planning process currently underway at the authors' university. The information technology plan task force has directed the university to consider requiring students to purchase/lease laptop computers. This requirement would supplement or replace the current environment which makes 1400 computers at various locations on campus available for student use almost continuously during academic sessions. In addition, most student residence halls are wired for connection to the campus LAN. Plans are underway to make older residence halls "connected" via wireless technology.

METHODOLOGY

Although the authors are primarily interested in the computer ownership requirements at peer institutions, we decided to use the *Chronicle of Higher Education* listing of colleges/universities as our frame ("How the Classification...", 2000). A stratified random sample of 20 percent of the frame was selected from doctoral-granting institutions (total of 151 extensive, 110 intensive), master's colleges and universities (total of 496 at level I, 115 at level II), and baccalaureate colleges (total of 228 liberal arts, 321 general, and 57 baccalaureate/associate). The provost/academic vice president at each selected institution was contacted via e-mail with a link to a web-based survey. If electronic contact could not be made, a letter was sent with an enclosed hard copy version of the survey. A follow-up contact was made via e-mail/mail approximately two weeks after the initial contact.

RESULTS

Forty-one private institutions and 59 public institutions responded to the survey. These 100 responses out of the 295 surveyed renders a response rate of 33.9 percent. Of these 100 colleges and universities, 23 are doctoral-granting institutions, 39 are master's colleges and universities, and 38 are baccalaureate colleges. Most (62 percent) were institutions of 5000 students or less. Table 1 shows the breakdown of respondents by size of student body.

TABLE 1

Size of Student Body	Frequency
less than 5000	62
5000 - 10,000	19
10,001 - 19,999	9
20,000 - 30,000	5
over 30,000	5

Thirteen of the 100 institutions that completed the survey instrument required students to own or lease their own computers. Of those requiring all students to have their own computers, 64 percent make this requirement for students in every degree program. The remainder of those surveyed have this requirement in place for only some of their programs.

One-third allow students to lease computer equipment, 40 percent require that students purchase computer equipment. The remainder of institutions which require students to have computers leave the decision to buy versus lease up to the students. Two-thirds of these schools specify that the computer must be a laptop computer.

Roughly 62 percent of those mandating students must have their own computers have had this requirement in place for 2 to 3 years. Eighty-three percent believed this endeavor has been successful. None of the institutions considered the mandate to not be successful.

Of those not currently requiring computer ownership by students, most were not considering changing this policy in the near future. For a breakdown of responses, see Table 2.

Chi-square goodness of fit tests were conducted for those institutions which have computer requirements in place to allow a comparison by institution (private versus public), type (doctorate-granting institutions, master's colleges and universities, baccalaureate colleges), and size of student body. Only one of these tests yielded a difference that can be considered to be significant. Fifty-six percent of those schools with a student body between 10,001 and 19,999 require students to come to campus with computers. All other categories of schools based on size of student body had fewer than 12 percent of responding institutions mandating that students must own or lease a computer (p = .002).

Table 2

Future Plans	Percent
Currently planning to implement computer requirement	3.6 %
Currently considering to implement computer requirement	27.4
Not considering such a requirement	69.0

CONCLUSIONS

This study did not culminate in any definitive results. It did provide us with some initial information concerning the percentage of institutions that are mandating students arrive with computers and some insight into the successes, failures, concerns, and limitations of these programs.

In our survey instrument we asked for a contact person at the university who would be willing to talk with us and provide a clearer picture of what is happening at the institution. Our next step in this research will be to contact these people and discuss their decision whether or not to mandate that students have computers and the reason(s) their institution made this decision. For those who chose to require computers, we would like to know the goal of their program and whether or not it is being achieved.

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APPENDIX
TECHNOLOGY REQUIREMENT QUESTIONNAIRE

DEMOGRAPHICS

1. Your institution is:
   - 41% Public
   - 59% Private

2. Type of university/college:
   - 23% Doctorate-Granting Institution
   - 39% Master's Colleges and Universities
   - 38% Baccalaureate Colleges

3. Size of Student Body:
   - 62% Less than 5,000
   - 19% 5,000 - 10,000
   - 9% 10,001 - 19,999
   - 5% 20,000 - 30,000
   - 5% More than 30,000

COMPUTER REQUIREMENT

1. Does your institution require students to own/lease their own computers?
   - 12.9% Yes (Please answer questions 2 - 6.)
   - 87.1% No (Please skip to question 7)

2. Are all students required to have their own computers or only students in some specific programs?
   - 64.3% All
   - 35.7% Some

3. Computer equipment for students is:
   - 33.3% Leased
   - 40.0% Purchased
   - 26.7% Either

4. Students are required to own/lease the following:
   - 66.7% Laptop
   - 0.0% Desktop
   - 33.3% Either

5. Your institution's computer requirement has been in place for:
   - 23.1% Less than 1 year
   - 61.5% Two to three years
   - 15.4% Four to five years
   - 0.0% more than 5 years

6. In your opinion, considering what your institution hoped to achieve by requiring students to have their own computers and the actual results being experienced, this endeavor has been:
   - 58.3% Very Successful
   - 25.0% Successful
   - 16.7% Neither successful nor unsuccessful
   - 0.0% Unsuccessful
   - 0.0% Very Unsuccessful

Now please skip to question 8

7. Although computers are **not** currently required at your institution, such a requirement is:
   - 3.6% Currently being planned
   - 27.4% Currently being considered
   - 69.0% Not being considered

8. Would you be willing to share details/opinions of the computer requirement currently enforced at your institution?

☐ Yes

☐ Via telephone
Number: ______________________
Best time of day: ________________
☐ Via e-mail
E-mail address: __________________

☐ Not at this time

THANK YOU FOR YOUR INPUT. IF YOU WOULD LIKE A COPY OF THE RESULTS, PLEASE E-MAIL US AT crandall@gasou.edu.

IMPLEMENTING AN ON-LINE "THIRD PLACE" FOR IS STUDENTS: SOME PRELIMINARY OBSERVATIONS

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ABSTRACT

The increased social fragmentation in the fast-paced lives of individuals, particularly college students, is resulting in many dysfunctional effects—disappearance of community feeling, loss in the ability to relate to one another, impaired ability to collaborate with others, and greater obstacles sharing and co-constructing knowledge. Technology is repeatedly offered as an answer. However, because existing technologies are designed by applying theories of economic efficiency and technological determinism, the implementation often results in further fragmentation. Oldenburg's idea of the "third place" provides a refreshingly new metaphor to conceptualize how technology-mediated interactions can enhance, not reduce, the sense of community. In the specific context of IS education, an on-line third place can not only enhance the sense of community among students, but it can also prepare students for careers in learning organizations operating in complex, dynamic, and global environments. Our preliminary attempts to implement the third place within an IS program seem to indicate that students accessing an on-line third place are able to experience relational development, collaboration, and cohesion. Such experiences are not only consistent with the notion of a community, but are also helpful in developing human resources that are suitable for distributed learning organizations of the future.

INTRODUCTION

Consider the following situation.

> A student is having trouble understanding the difference between the concepts of partial and transitive dependencies covered by his database professor. He looks through his textbook, re-reads his notes but still can't grasp the difference. The exam on normalization is at 7:45 a.m. the next day, so in desperation he calls a friend in the class and asks for her understanding of the concepts. They agree to meet at the local coffeehouse and discuss the concepts. At the coffeehouse, many other students from the class (as well as from other MIS classes) are also present. They naturally break up into small groups of 3 or 4 and begin a conversation on concepts related to database design. Leaving the coffeehouse a few hours later, the student reflects on this coffeehouse experience. His frustration and confusion have disappeared, and he feels a sense of accomplishment in talking through the different concepts related to this course, and tying in topics from other courses as well. He expects to

> perform well in the exam the next day. What is more, he seems to have enjoyed the social interactions. The conversations in the coffeehouse have allowed him to blow off steam, relate to others with similar interests, whether academic, extracurricular or professional, and feel a sense of connectedness with his classmates, many of whom will be his friends, his professional peers, and "contacts through his entire life.

Shouldn't every MIS student have the opportunity to take advantage of such a coffeehouse? Wouldn't the education process be significantly enriched if such an opportunity could be provided systematically and consistently as part of many MIS programs, especially in those that have been forced to become impersonal in trying to cope with the enormous enrollment growths without matching resources? Also, recognizing the time pressures that a majority of students face through much of their college life, would it not be a worthwhile endeavor to provide students with access to such coffeehouse environments with minimal space and time constraints where they can be part of a community?

In this paper, we describe the notion of "third place proposed by Oldenburg (1989) as a way for enabling a sense of community among students, and provide a preliminary discussion on our experiences in utilizing a web-based technology to provide a "third place for information systems (IS) students.

The importance of creating a community of peers has never been more pronounced, especially for college students. Over 38% of college students work while attending college (Lipke, 2000). This leaves a student little time but to run from class to work to home during a day. In addition, the increasing level of technological mediation in almost every activity has left our lives seriously fragmented (Speier, Valacich, & Vessey, 1999), devoid of time and opportunity for interacting with others (Kenway & Bullen, 2000). Such fragmentation appears to be having a number of dysfunctional effects. It promotes unsociable as well anti-social behaviors, raises barriers for students in acquiring certain kinds of knowledge, and inhibits their ability to attain mutual understanding with others, a fundamental requirement in any cooperative activity, especially systems design and implementation (Churchman & Schainblatt, 1965). Thus, the availability of a forum for informal interaction is necessary not only for the interest of attaining knowledge but also for ensuring a stable and just society.

Focusing specifically on IS education, we argue that the development of community has numerous outcomes that are not necessarily available in more traditional methods of delivering IS courses. Most traditional IS courses help students increase their understanding of certain technical knowledge, and acquire technical skills focused on developing, managing and maintaining operating systems and applying certain programming languages. While certain types of knowledge (propositional knowledge) can indeed be acquired through traditional classroom lectures, other types of IS knowledge (conceptual and symbolic knowledge) cannot be satisfactorily learned without interactions within a community setting (Sarker, Lau, & Sahay, 2000). We believe that creation of an online third place such as one resembling a coffeehouse described in the opening scenario can be an effective strategy to facilitate student interactions, and thus, learning.

The remainder of this paper is organized into three sections. First, we describe the third place concept and the role of technology in developing an on-line third place. Next, we describe our experiences in developing an online third place as part of an undergraduate database systems course at a medium-sized state university in the inland northwest region of the US. Finally, we discuss the implications that the results of this case study have on the future of IS education and on the development of IS courses.

THE "THIRD PLACE" CONCEPT

Study groups are not new in IS education, but the creation of a unique environment called a third place is new (Schuler, 1996); providing students with the opportunity to converse on a wide variety of topics, and to debate and dissent in an on-line space. Ray Oldenburg (Oldenburg, 1989) describes a third place as a space where community members gather and interact. In his description, a first place is home, a second place is work, and a third place is considered a "hang out space. For example, a physical third place would be a coffee shop, a bar, a beauty parlor, or a drugstore soda counter. Oldenburg suggests that people seek out a third place because the functions it serves are missing from their lives. Building a community, with common bonds and ties, social interaction, and shared location (Hillery, 1955) in an educational environment provides students with a similar “hang out space and also teaches them how to create an informal public life themselves.

Conversation is the main activity in a third place and occurs with a spirit of inclusion rather than exclusivity (Hamman, 1997; Schuler, 1996). In addition, conversations in the third place enable debating, dissenting, and keeping democracy alive (Atkin, 1998). These dialogs provide an opportunity to flush out questions, sound out protests, and form opinions in other words, develop a shared though critical understanding of issues. Members of these third places know they can gather and be assured that acquaintances will be present at almost any time of day or night. These spaces welcome everyone and no one is expected to play the role of host or guest. This neutral ground encourages people to gather, not to talk to the owner or manager of the shop, but to converse with other patrons. Therefore, third places, as conceptualized by Oldenburg, are more than mere physical spaces. They *require* the interaction and companionship of people. The key to the existence of a third place is the neutral ground they provide for conversation that is not based on social or economic status and is away from home and work (Oldenburg, 1989; Rheingold, 1993).

For many of us, and this is especially true for college students, the opportunity to interact in a third place such as a neighborhood coffeehouse is limited. Our sense of community has declined as we have become more suburbanized. With this decline in community comes a lack of social cohesion and satisfaction in our society. Oldenburg suggests that a lack of community is poisoning not only an individual's wellbeing but also grass-roots democracy and civil society. Certainly, these are important concerns for the higher education system that is charged with producing not only individuals with necessary skills but also individuals who can play the role of responsible citizens within their communities. The rapid expansion of Internet technology provides an excellent opportunity to address the difficulties associated with time-space fragmentation by extending Oldenburg's third place concept to an online platform (Garton, Haythornthwaite, & Wellman, 1997). Vannevar Bush and Douglas Engelbart's vision of the original computer is closely aligned with an online third place. The computer was seen as a tool to expand our intellectual powers. Every new step in technology, whether a new medium or changes within a medium, has brought different ways of distributing the message while still maintaining and preserving aspects of the old system (Postmes, Spears, & Lea, 2000). The Internet enables the creation of a community environment for learning that is relatively seamless for the learner and reflective of the work environment they will experience in the future.

LEARNING AND THE (ON-LINE) THIRD PLACE

A third place promotes originality and provides stimulation to the members. Online communication adds several unique components to a third place: a diverse population, a novelty of conversation that is predictable yet unpredictable, the opportunity to converse in an unselfish and a selfish manner simultaneously, and the dialectical experience for an individual of being a participant as well as a spectator at the same time (Atkin, 1998). Although most online interactions are primarily conversational and text based environments, they can promote a third place feeling (Harasim, 1990). In fact, many scholars have persuasively argued that such conversational and text-based environments greatly enhance learning. Papert (1996) contends that we learn by doing, and we learn even more if we combine our doing with talking and thinking about what we have done and what could be done. Similarly, Vygotsky argues that the process of articulating thoughts into written speech involves deliberate analytical action. He calls this change from “inner speech or verbalization to written speech a deliberate structuring of the web of meaning. Gage adds (Harasim, 1990) that writing is thinking made tangible. It is a way of holding a thought still enough to examine its structure and its flaw. Learners in an online environment report increased attentiveness to the content of a written message over a verbal message. Text offers an equalizing effect allowing everyone to respond regardless of social, emotional, or physical considerations (Harasim, 1990).

Instead of being a distant observer in a large lecture room, students in such environments are likely to be actively involved in the material (Smith & MacGregor, 1992). Higher academic achievement and advanced cognitive development have been shown to occur with social interaction as opposed to individualistic learning activities (Bosworth & Hamilton, 1994; Johnson & Johnson, 1994). Settings where students are free to move around and discuss their thoughts and ideas with their peers enhance the learning. There are many ways or methods of using collaborative learning but all the strategies are centered around the students' process of investigation and their discovery or application of the knowledge, not a teacher's presentation of the material (Bosworth & Hamilton, 1994). Working in a group, each member is expected to be a responsible participant. An on-line learning environment provides the tool to allow multiple intellectual minds to join together (Bruffee, 1995; Bosworth & Hamilton, 1994; Cyganowski, 1990; Smith & MacGregor, 1992).

A virtual third place also spawns a learning community. Interaction and communication are essential to the development of an effective learning situation. Learning communities foster student engagement and achievement; a core setting where everyone has equal access and an informal network (Gabelnick, MacGregor, Matthews, & Smith, 1990). Online third places attach value on diversity within the group and foster internal communication to promote caring, trust, and teamwork (i.e., relational skills) in addition to sharing task related skills, all critical for organizations to be successful. Students in a learning community interact with the content material, the instructor, and other students. Working cooperatively with other students allows them to look at something from a different perspective, and understand their role as an individual within the group (Kowch & Schwier, 1997; Lenning & Ebbers, 1999; Meisel & Marx, 1999). Conversation, dialogue, and debate provide a perfect union of egoism and altruism. Although activity in a third place is largely unplanned and unscheduled, a learning community structure can be loosely structured around topics of interest. Senge's "learning organizations (Senge, 1990), which are believed to be models of organizations that can excel in today's complex, dynamic, and globally competitive business environments, have much in common with Olderburg's idea of third place within the educational setting. Senge's vision was for employees to expand their capacity to create results that they truly desire, nurture creative thinking, and help people learn how to learn together. We believe that an on-line third place can be a fertile training ground for future knowledge workers (including, but not limited to, IS professionals) who are likely to find themselves in learning organizations. In addition, we feel that the sense of belonging to a community of peers can, in many respects, minimize anti-social acts such as malicious hacking which has been on the rise in recent times.

AN IMPLEMENTATION OF THE THIRD PLACE AND PRELIMINARY ANALYSIS

An experimental online learning environment called Speakeasy Studio & Café was used for to create a third place for students in an undergraduate IS course. Metaphorically developed on a café setting, the space is designed to "simulate a coffeehouse-like environment, and provide the feel of a third place. The environment provides both an asynchronous and synchronous option for flexible interaction.

Participants in our case study were undergraduate IS students enrolled in a database design course that was being taught by the first author. Most of the students participating in our study were in their last semester of study before graduation. The interaction among the students within the on-line space provided by Speakeasy was the primary focus of our investigation. It is worth noting that the online environment (the third place) was provided as a *supplement* to the face-to-face interaction during class times (the second place), and was not intended to be a *substitute*.

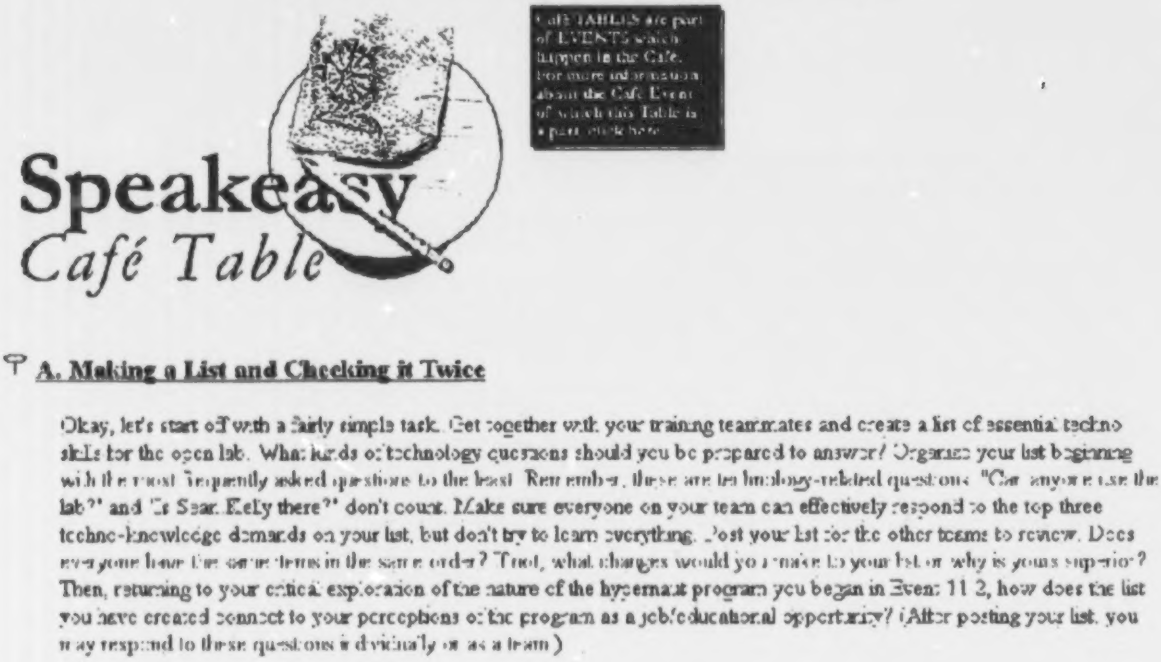
Students in the course were given access to the system. To get the specific café assigned to the course, a student would log on to the Speakeasy system and then select the specific "neighborhood representing a broad sub-group (e.g., the relevant department within their college) within the university community. Within the neighborhood are various cafés or courses at the university. Upon entering the café assigned to their course, students would see different scheduled events, some events currently playing, and others scheduled for the weeks that follow.

FIGURE 1
SPEAKEASY STUDIO & CAFÉ WELCOME SCREEN

Welcome
to the
Speakeasy
Studio
& Café
[Start]
[Login]

Each event was assigned a table that represented an activity, which related to the event or topic being covered. Tables, complete with coffee cup rings for visual appeal, become the space to discuss and debate issues related to the course. A table can also be a workspace for a team to use for a project (see Figures 1 & 2 for screenshots of the interface). The dialog between students at each table served as the data for our efforts to identify preliminary themes related to the creation and outcomes of a third place environment. Results of our analysis are reported in the following section of this paper.

FIGURE 2
SPEAKEASY STUDIO & CAFÉ INTERACTION SPACE



Café TABLES are part of EVENTS which happen in the Café. For more information about the Café Event of which this Table is a part, click here

A. Making a List and Checking it Twice

Okay, let's start off with a fairly simple task. Get together with your training teammates and create a list of essential techno skills for the open lab. What kinds of technology questions should you be prepared to answer? Organize your list beginning with the most frequently asked questions to the least. Remember, these are technology-related questions. "Can anyone use the lab?" and "Is Sean Kelly there?" don't count. Make sure everyone on your team can effectively respond to the top three techno-knowledge demands on your list, but don't try to learn everything. Post your list for the other teams to review. Does everyone have the same items in the same order? If not, what changes would you make to your list or why is yours superior? Then, returning to your critical exploration of the nature of the hypernaut program you began in Event 11.2, how does the list you have created connect to your perceptions of the program as a job/educational opportunity? (After posting your list, you may respond to these questions individually or as a team.)

Next we discuss some preliminary themes that emerged from our analysis of student conversations within the "third place created using an online environment, Speakeasy Studio and Café.

Analysis of On-line Conversations

From the on-line conversations, we derived themes pertinent to the third-place concept by drawing on methodological guidelines from the grounded theory (Glaser & Strauss, 1967) and ethnographic traditions (Van Maanen, 1988; Agar, 1986). We discuss three inter-related themes that emerged from the data, which we see as central to the idea of the third place. The themes from this analysis are labeled: relational development, collaboration, and cohesiveness (see Figure 3). Student comments related to each theme can be found in Table 1. The themes identified here are consistent with the ideas of a shared locality, social interaction, and common bonds or ties that are seen to facilitate community development (Hillery, 1955).

Relational development. Working in groups/teams is an essential part of our lives, more so now with the added opportunity of distributed teams in the workplace (Lipnack & Stamps, 1999). Several aspects of our work include group interaction. Although just gathering people together in one space provides no guarantee that this collection of individuals will become a community, with the development of a relationship among these individuals, their shared experiences do tend to coalesce, thereby facilitating the formation of a shared sense of community. The first theme identified was relational development related to group formation.

FIGURE 3
THIRD PLACE THEMES

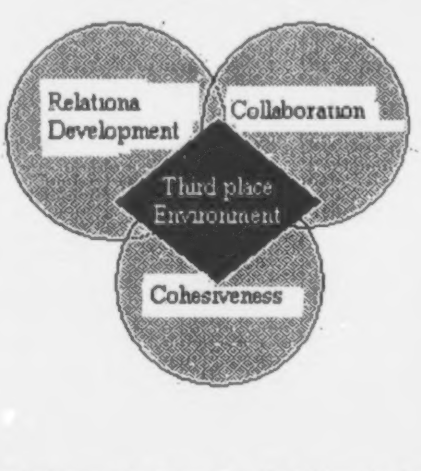


TABLE 1
THEMES AND STUDENT COMMENTS

Themes	Examples
Relational Development	Student 1: *What I would give to become a ski bum.*
	Student 2: *I have a friend who worked at some resort in Vail. He waited tables at night and skied all day. He served people like Warren Miller and Jack Nicholson.*
	Student: *I like working in a group, especially if it is a good group, i.e. everyone does his or her share of the workload.*
	Student 1: *Interesting story, good talking to you.*
	Student 2: *I was able to go to Japan, Delaware, and Virginia with the AF. I was stationed in DE for 3 years.. pretty much sucked.*
Collaboration	Student: *I think I still need to learn the value of working on a team. Trusting team members to not only do their share of the work but to do it well, rather than trying to do it all myself. I need to realize the value of other people's input and perspectives and not focus so much on my own answers as the right answer.*
	Student: *I am a hard worker and I work well in groups. I have been subjected to many different people and personalities because of my background. I am eager to do well, and I am willing to work with anyone who wants to do well and is not afraid to put the time in to do so.*
	Student 1: *My POM internship was honestly a good experience and I really do recommend it. I feel I was at a disadvantage being a sophomore intern. It was a pilot program to see just how young can POM majors be picked for internships.*
	Student 2: *You may not want to hear this, but thanks to those of you that interned in the pilot group [company] has made significant changes in the internship program. Of course it is not exactly the same in all of the FABs but similar.*
	Student 1: *Actually I am glad to hear about the internship being even better. At least what we did helped them plan a better internship that you get more out of. I would only be upset if it hadn't gotten better each year!*
	Student: *I hope that is what you guys were thinking. I had a question about the top two entities on your diagram. I believe (sp) it is a one-to-one relationship...I assumed that the attribute was functioning as a foreign key, but then I realized that the primary key from the mandatory side needs to go to the optional side... If that's what you guys were thinking, just let me know and I will change the relation.*
	Student: *We meant to use [attribute 1] throughout the diagram. We intended to use [attribute 1] as a foreign key in the entity Status.*
	Student: *What is the primary key going to be for the PLATE_APP entity there are no candidate keys listed. Maybe enter a permit_ID entity?*
	Student: *** We would suggest turning the Student_D into a subtype with overlap.* Student: *If you have any comments or questions regarding this transform, please let us know.*
Cohesion	Student: *Thanks for the response. I look forward to kicking some serious butt in this class with you and Sam. I think we'll do great!*
	Student: *The team will not share information about our ideas or policies with other groups.*
	Student: *The team will not share information about our ideas or policies with other groups.*
	Student: *Wow, It is always great to find a fellow Linux User. I have used linux for both a desktop environment as well as a server.*

Group work provides students with a multitude of different perspectives that they may not have considered before. For a group to be effective they must address two dimensions, task and relation (Rothwell, 1998). Forming a group provides diverse approaches to the task dimension because of what each individual brings with them (Dennis, Aronson, Heninger, & Walker II, 1999). The relational dimension can be linked to social interaction. Socialization of undergraduates is very important to the college experience (Newman, 2000). John Dewey provides a description of the importance of social interaction with the quote "Not only is all social life identical with communication, but all communication is educative (Burbules & Bruce, (in press)). The more students get to know each other, the more information they share about their non-academic life as well as their academic lives. Significant learning can occur in this situation, with students' recursively co-constructing knowledge (Stiles, 2000).

Community and education are dynamic processes where knowledge is not a product to be accumulated but an active process in which the learner attempts to make sense of the world. A learning community fosters student engagement and achievement. Students who are actively engaged in the learning process have two things in common, shared knowledge and shared knowing (Lenning & Ebbers, 1999). Research suggests that students who have a passive, un-engaging learning experience do not develop depth of knowledge (Stiles, 2000; Bruffee, 1993; Johnson & Johnson, 1994).

At the beginning of the semester students in the database design course were asked to post a letter of introduction in the online environment that included some mention of their team-oriented and project-oriented strengths and weakness (i.e. information pertaining to task and relational dimensions). Students were to respond to their classmates' introductions and communicate online in an effort to form teams for the course project. A review of the initial conversations that took place in this online environment showed that conversation tended to be relationship-oriented rather than task-oriented. Consider for example the following conversation between two students about skiing.

Student 1: *What I would give to become a ski bum.*

Student 2: *I have a friend who worked at some resort in Vail. He waited tables at night and skied all day. He served people like Warren Miller and Jack Nicholson.*

This discussion had nothing to do with the strengths and weakness of the student's ability on a team. On the other hand, it provided insight into what the student enjoys doing outside of academic life, which could be an important issue in the development of a relationship, even professional. Couch (1996) refers to such (seemingly irrelevant) conversations as the exchange of evocative symbols and contends that collaborative relationships are enabled and strengthened through use. Providing a space for students to discuss about issues related to their personal lives is an important function of a third place. Such social interactions are justifiable not only because they help in the formation/maintenance of productive professional relationships, but also because the college experience of students cannot be separated from the social interactions that are needed for the existence of society that is not completely dysfunctional.

Yet, relationships in a professional setting can be meaningless without at least a background concern regarding the task dimension as well. Transcripts of the third place revealed interspersed use of what Couch (1996) refers to as "referential symbols (conversation segments related to tasks, time coordination, etc.) with evocative symbols among students. An example of referential symbolism even at an early stage of relationship development is:

Student: *I like working in a group, especially if it is a good group, i.e. everyone does his or her share of the workload.*

It is apparent in this message of self-presentation, that this student is signaling future (or potential) teammates his general comfort in working with others, though he also indicates his awareness of the importance of distributing the workload and staying on task (Rothwell, 1998), a fundamental concern in systems project management.

Informality. A sub-theme associated with relational development is the informality of the writing. This sub-theme is present in the tone and style of the writing that students use with each other. Casual language, in electronic text, is similar to "chit-chat you might have sitting at a table. This is also a way of enhancing the relational dimension. Informal conversation, just as in formal conversations, uses established noms of the community. In a formal setting you would introduce yourself and provide information about who you are. The students in this case were not strangers; many of them had had courses together in the past and some had even worked together on teams. Although the students had been aware of each other, they didn't necessarily know each other well. They did use introductory greetings and descriptions about themselves (Barker & Kemp, 1990). Many of the follow-up questions were to garner more information about something that was shared. It might be new information such as an internship the student had experienced or information on an awaiting event such as a birth in the family. Slang or the use of established abbreviations also displays the informality of the message.

Student 1: *Interesting story, good talking to you.*

Student 2: *I was able to go to Japan, Delaware, and Virginia with the AF. I was stationed in DE for 3 years... pretty much sucked.*

Using casual language and slang ("sucked) indicates a degree of comfort in the interaction. As Oldenburg suggests, people are seeking out informal, public places such as a third place because it is missing from their lives. The tone and style of language used by the students in the interaction is supportive of that suggestion (Berge & Collins, 1995).

Collaboration. A group needs to have both the task and relation dimensions balanced in order to be effective. A strong commitment to the project is also essential to effectiveness (Kirkman, Jones, & Shapiro, 2000). In order to be effective on the task and relational aspects, the group-members must be proficient collaborators. Collaboration is the next theme that emerged in this study. Collaboration is defined as a naturally occurring social act wherein peers not only work together towards a particular goal but also learn from one-another (Gabelnick et al., 1990). As the previous theme has addressed, interaction and the sharing of information is a way to collaborate with others. Collaboration is an *active* process, not one that takes place in isolation. Talking about information allows us to organize our thoughts and to make our ideas clearer. In a discussion, different perspectives are articulated and debated. The purpose is not to come to consensus to but to create knowledge and meaning individually (Bruffee, 1984; Bruffee, 1993; Johnson & Johnson, 1994). Collaboration in the form of group work increases a student's engagement in the learning process (Johnson & Johnson, 1994).

One of the activities in this case was for students to collaborate on forming project teams. The students sought information about potential team members. In discussions with other students, a student would look for information to make a decision on group membership. This created an inclusive understanding of each other's strengths and weaknesses. In the process of finding out information, the students asked questions and were able to identify with one another based on responses provided.

A group that collaborates more and interacts on a personal level increases the relational dimension of the group as well. As a personal relationship develops, there is greater personal accountability (Johnson & Johnson, 1994). A sense of belonging to a group also tends to boost the desire to learn. One student clearly articulated the dichotomy of teamwork.

Student: *I think I still need to learn the value of working on a team. Trusting team members to not only do their share of the work but to do it well, rather than trying to do it all myself. I need to realize the value of other people's input and perspectives and not focus so much on my own answers as the right answer.*

Collaboration becomes part of the balancing that is done between task and relational aspects of a group. Balancing is more fragile in a technology-mediated environment where students are juggling classes, work, family, and personality preferences, and this may be transparent to other members in the group. Some groups that focus on the task and lose sight of the relational aspect are less effective than those that have shared purpose and collaborate on all dimensions (Rothwell, 1998).

Student: *I am a hard worker and I work well in groups. I have been subjected to many different people and personalities because of my background. I am eager to do well, and I am willing to work with anyone who wants to do well and is not afraid to put the time in to do so.*

As the project proceeded, it was quite apparent that peers were learning from other peers through debates, critical examinations of artifacts (ER diagrams), and constructive suggestions, as the following exchange shows.

......

......

Student 1: *I hope that is what you guys were thinking. I had a question about the top two entities on your diagram. I believe (sp) it is a one-to-one relationship ...I assumed that the attribute was functioning as a foreign key, but then I realized that the primary key from the mandatory side needs to go to the optional side... If that's what you guys were thinking, just let me know and I will change the relation.*

Student 2: *We meant to use [attribute 1] throughout the diagram. We intended to use [attribute 1] as a foreign key in the entity Status.*

It was also interesting to see that collaboration occurred not only *within* groups but *across* groups as well, thereby indicating formation of a broader learning community. However, we did notice that task-related conversations among members of different groups tended to be more formal and polite than among members of the same group.

Motivation and support: Another aspect of collaboration is providing motivation and support for classmates. This became a sub-theme related to the collaboration. From the messages provided there is a strong sense of support for other students. Even with the informality and sarcasm in some of the written messages, there is a sense that students care about others in the class. The message could feature a question of what type of internship a student may have, or express amazement regarding the fact that a student can be employed, have a family, and be a student all at the same time. This support seemed to provide motivation for students to continue, and perhaps to seek excellence. It also becomes a driving force for students to want to come back to an online space and further create a third place atmosphere.

Student 1: *My POM internship was honestly a good experience and I really do recommend it. I feel I was at a disadvantage being a sophomore intern. It was a pilot program to see just how young can POM majors be picked for internships.*

Student 2: *You may not want to hear this, but thanks to those of you that interned in the pilot group... [The company] has made significant changes in the internship program. Of course it is not exactly the same in all of the FABs but similar.*

Student 1: *Actually I am glad to hear about the internship being even better. At least what we did helped them plan a better internship that you get more out of. I would only be upset if it hadn't gotten better each year!*

Collaboration between all classmates was strong during the team formation stage, but as the teams formed, there seemed to be much greater intra-group collaboration. One task that required students to work together across team boundaries was when each team needed to comment on the Entity-Relationship Diagram (ERD) of another team it was paired with, and transform this ERD to relations. The purpose of the activity was to push the students along the conceptual design continuum from the diagram to the transformation process. By working with another team's diagrams, hidden assumptions made by the original formulators of the diagram could be unearthed. Interestingly, the between-group collaboration was supportive and not critical, as we had expected. Polite suggestions and questions regarding the decisions made were more typical of the between-group interaction.

Student: *What is the primary key going to be for the PLATE_APP entity there are no candidate keys listed. Maybe enter a permit_ID entity?*

Student: *** We would suggest turning the Student_D into a subtype with overlap.*

Student: *If you have any comments or questions regarding this transform, please let us know.*

Members of the groups collaborated and created knowledge based on the understanding of the material. Each group varied on a continuum of learning, but most appeared effective in producing an adequate design. The across group environment may be viewed as simulating a learning organization to some extent, where all members of the organization contribute to and benefit from the shared knowledge, not just the ones within a particular team (as is characteristic of traditional hierarchical organizations with minimal knowledge creating and sharing ability).

Cohesiveness. The final theme identified from the conversations of the students was cohesiveness. Cohesiveness is defined as the common bonds or ties that unify the group. This concept is key to the development of a community and third place (Anderson & Kanuka, 1997; Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000; Oldenburg, 1989). Cohesion in the group is represented by the *harmony* among the members. In a group environment, the ability to work toward a goal often requires the cohesion among the members (Postmes, 2000). This is especially true when tasks are complex and interdependent, and require mutuality and trust among members to accomplish together. Mere coordination among group-members through the use of referential symbols is not sufficient for collaboration in these cases; instead true collaboration can occur only when group cohesion exists, i.e., individuals in the group feel a sense of closeness.

In our case, we could identify several instances of group cohesion among students.

Student: *Thanks for the response. I look forward to kicking some serious butt in this class with you and Sam. I think we'll do great!*

The students in this case were well acquainted with each other from other courses, and had shared a common set of experiences, and this created a personal connection (Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000).

Communication is the key to discovering common bonds. During one conversation, two students discovered that they shared a common interest in Linux. Without the opportunity to participate in a dialogue, students would not have discovered this common interest, and thus, would not find it easy to develop the level of cohesion that was achieved in this case.

Student: *Wow, It is always great to find a fellow Linux User. I have used linux for both a desktop environment as well as a server. However, lately I have been more intrigued by its server capabilities than anything else.*

This small thread of commonality led to a lengthy discussion of the uses and importance of Linux.

It is important to point out that cohesion in a learning-community does not necessarily imply a consensus on all topics. Rather, the individuals knit cohesively in a learning community feel comfortable in surrendering their autonomy and their personal convictions for a favorable outcome of the group. Sharing leadership in the group creates greater commitment to the decisions of the group, and this further enhances individual students' communication and interaction skills (Meisel & Marx, 1999).

Interestingly, in many cases, cohesion was evident *within* but not across teams. For example, the charter of one of the teams explicitly stated that members must not share project-related information with other groups.

Charter: *... The team will not share information about our ideas or policies with other groups...*

While this observation was initially interpreted by us as an indication that an on-line community had not been successfully formed, we gradually came to the realization that cohesion often relates to the micro level of our community. Competition at a micro-level seems to often override an overall cohesiveness for the macro level (Aquino & Reed II, 1998). Another important point emerged from our analysis of data related to cohesion. While technology does create the opportunity for us to become more global, it is clear that cohesion doesn't extend to all levels. The interests of students seem to have coalesced with members of their immediate project group, and not so much with the members outside of their own group or micro community. We believe that this finding is not at all inconsistent with the notion of a community for example, we may have individuals in families, families in a neighborhood, and so on. While individuals in a neighborhood may indeed develop relations around certain issues, and even collaborate on certain issues, the degree to which there is a merger of interests within families and across families is usually not quite the same. Yet, individuals from different families are able to live together as a social whole.

CONCLUSION

Imagine a local café having a number of available tables and chairs. On any given day, many students leave their classrooms, work, or homes to visit the café. On some days, the group collects around a single large table discussing an upcoming exam. On other days, this group of students might divide into smaller groups of three or four, each sub-group sitting at its own table discussing a different topic. A person listening in might observe one team discussing an upcoming project milestone. At another table, the discussion might be focusing on social plans for the weekend. The dialogue that takes place among these team-members can stop and start, and go on for days or weeks as the individuals gather more information, think about the issues raised or take time for other responsibilities in their lives. There is no coffee served at this café, students are welcome to bring their own; and there are no requirements that shirts or shoes must be worn. The manager of the café is always present, arranging the tables or planning the discussions, but rarely does the manager sit at the tables or get involved in the discussions. The emphasis is on the students, their tasks, and their relationships.

Whether this café is a physical entity or a metaphor created in an online environment, the space is one that offers a location that has the potential to serve as a third place. In this paper we have described the third place concept for developing community among IS students, and shown one application of web-based technology to create a third place.

Based on our (first-time) experiences in enabling a third place, we would like to state the following tentative conclusions.

> The on-line third place can help students experience social interactions with peers without significant time-space constraints. For example, a student may find peers in the third place at any hour of the day without having to leave his/her home.
>
> This interaction can lead to a number of useful outcomes: It may provide students an opportunity to blow off steam, "hang out and relax by engaging in "chit chat. It may also help students develop the skills to identify with others in addition to developing a mutual understanding with others. These skills are a prerequisite for the health of a society, as well as a requirement for any kind of collaboration to occur, be it in the personal or professional arena. Finally, numerous conversations can be going on simultaneously as if forming a collage, with many individuals sharing similar interests with some of the other participants in the conversations. The possibility of orchestrating a complex pattern of interactions in a face-to-face environment is difficult if not impossible.
>
> Most importantly, interactions in the on-line third place can allow a sharing of knowledge among students and enable critical discussions on individual students' work, while retaining the casual and non-threatening atmosphere. While we have not obtained any objective measure of enhanced learning this time, we dare say that students have developed a deeper understanding of the material by engaging in conversations on the material.
>
> We found that an on-line third place does enable relational development and collaboration; however, the entire community does not function as one cohesive unit, but rather exists as a loosely coupled conglomeration of cohesive sub-communities. One conclusion for this micro-community effect is that students did not have the opportunity to use an online space as a supplement until their final semester of college. Earlier introduction of a third place may have enhanced the level of cohesiveness in the class as a whole, and reduced the inherent (sometimes petty) competitiveness of some of the students. Increasing an emphasis on communication and conversation helps to balance competitiveness and collaboration (Aquino & Reed II, 1998). A possible direction for future research is to implement a third place environment early in the students' educational process, and to follow the changes in their attitudes and behaviors over time till they graduate.

To conclude, we wholeheartedly agree with Oldenburg's assertion that a third place, especially in this age of increased social fragmentation, can serve important functions for people that are missing from their lives. Building an online third place for education of IS students teaches them how to create an informal public life, and how to acquire knowledge actively though co-construction, not just passively by acting as a receptacle of knowledge encoded in a lecture delivered in a traditional classroom. The skills to adapt, develop relations, and collaborate with peers that are gained through participation in an on-line "third place are critical to the success of an employee in the dynamic work environment of today and tomorrow. There is value to being sociable, in learning from peers, and in developing a sense of community, and the sooner we can get students to recognize this proposition, the more meaningful their college education will be for them.

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COMPARING THE EXPECTATIONS OF INFORMATION TECHNOLOGY STUDENTS TO THE EXPERIENCES OF GRADUATES

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ABSTRACT

Universities teaching information technology need to know what beliefs their students hold about the information technology job market and what happens when their students enter the work force. Surveys were sent to students and recent graduates in information technology majors to compare the beliefs of the former to the experiences of the latter regarding entry-level jobs in the information technology field.

Despite anecdotal evidence that students' expectations are unrealistic, this study found that students' expectations and graduates' experiences generally matched. Both groups recognized the importance of general knowledge and skills, and ranked problem solving as the most important skill. They felt the university is doing a good job teaching them most of the important knowledge and skills.

INTRODUCTION

While the number of available jobs in Information Technology has declined somewhat in the past year, IT continues to be one of the most attractive areas for graduating students. In recent years there have been anecdotal stories of students starting at six figure salaries, making much more than their professors. Some students also believe that they can start in or quickly obtain positions as analysts and project leaders, rather than spend time in more typical entry-level jobs such as programmers and help desk support. As a result, concerns have been expressed that student expectations tend to be unrealistic.

From the perspective of educators in the IT area, one of the major concerns is keeping programs up-to-date. Technology is changing rapidly, and while the basic concepts of programming and data management have not changed that much over the past 20 years, the tools used certainly have. There is a continuing need to keep programs current.

This study attempted to address these issues by surveying the students and recent graduates of IT programs at a mid-sized western Canadian university. This university offers two separate four-year degrees that prepare students for jobs in the information technology (IT) sector, a B.Sc. in Computer Science and a B.Mgt. majoring in Management Information Systems (MIS). Both degrees are typical of those offered at similar universities. The Computer Science program requires much more programming and emphasizes more technical issues. The MIS major studies both technical and behavioral issues in IT and includes courses in all areas of business, including accounting, finance, organizational behavior and marketing.

This paper attempts to answer the following questions.

What are the job expectations of current information technology (IT) students?

What skills and knowledge do IT students think are important in the current job market?

What skills and knowledge have recent graduates found to be most important?

What kinds of jobs are IT graduates doing?

LITERATURE REVIEW

Employment in the information technology sector has been growing rapidly. All businesses today feel the need to leverage technology in order to be competitive. Despite the recent downturn, there are apparently still 600,000 unfilled IT positions still available in the U.S. (Joachim 2001). This demand has put pressure on educational institutions to expand their programs, but qualified professors are in equally short supply. Moreover, the constant changes in technology make it difficult for slower-moving universities to update their existing programs to dovetail with the market. Some studies, such as Jacobson and Armstrong (2000), have attempted to study employer needs in this market.

Equally interesting is the effect the market is having on student expectations. All IT students are aware of the skills gap so frequently mentioned in the media. Most cities now have independent schools offering "quick fix solutions that promise IT careers to anyone after a six month to one-year program. Students' expectations are affected by these ads and the mention of technologies that are often not in place at universities.

Despite this continual change, some general knowledge and basic IT knowledge requirements remain relatively constant. General knowledge and skills that remain pertinent through the turbulence of change are interpersonal communications; interpersonal behavior; oral, written, and multimedia communications; and management of IS projects (Doke & Williams, 1999). Becker, Gibson, and McGuire (1994) identify key theoretical concepts that should be included in information systems curriculum: systems analysis, systems design, software engineering, testing, database management, data communication, and decision support systems. Also, the balance between training and education must be considered (Vermond, 1999). IT training has a short shelf life; skills that are current today may be out-of-date tomorrow. Education has a longer shelf life because it teaches how to use tools to solve problems. Universities tend to focus on education over training. Current training will allow recent graduates to function in entry-level jobs, while education will help them later in intermediate-level jobs.

One study found academic and industry respondents had different perceptions of market needs (Heiat, Heiat, & Spicer, 1995). The industry stated the most urgently needed skills were problem solving, PC skills, multimedia, networking, and Geographic Information Systems (GIS), while the academics felt the most needed skills were computer-aided software engineering (CASE) tools, Windows, Unix, and systems analysis. However, they did not attempt to measure the perceptions of students.

Students intending to major in IT may have some misconceptions about the field (Mawhinney, Cale, & Callaghan, 1990). Students in this study thought they would be working alone on programming tasks when they graduated. However, they expressed a preference to work with other people. The authors concluded that students were getting the mistaken message that IT careers were all in programming because of the focus on programming courses in their degrees. They suggested developing "creative approaches to the placement and content of programming activities in both the major and the career.

METHODOLOGY

The first step in designing the survey was to determine which types of knowledge and skills should be included. To do this, 35 recent IT job postings for work term positions were analyzed. Students at the university have the option of completing a work term as part of their studies, and these jobs are similar to typical entry-level positions. These job postings identified 23 knowledge and skill items in three distinct categories: general IT knowledge and concepts, specific software package skills (e.g., Excel or Oracle), and general knowledge and skills applicable to any job. The job descriptions were then grouped by main job task, and 12 tasks emerged: analyst, database design, database modeling, database support, end-user training, help desk, network maintenance, software design, software development, technical writing, testing, and web design.

It could be argued that job postings reflect what the employers think the universities can provide. However, the same job postings are generally sent to all universities in the area and many included skills that are not part of either IT program at our university. Thus, we believe they are reasonably representative of what employers expect from Computer Science and MIS students and graduates in general.

Three questionnaires were then created, one for each group.

1. entering students;
2. exiting students; and
3. IT graduates of the university.

Some questions were common to all three questionnaires, while others were aimed specifically at one respondent group. The common questions had to do with sources of knowledge about the IT marketplace, knowledge and skills, job tasks, starting salaries, and time spent interacting with people. A sample questionnaire is attached. A variety of methods were used to administer the questionnaires. Most subjects were asked to fill out a web survey, some were given or mailed a paper survey, and some were sent the survey over e-mail. In all cases, subjects were given the option of filling out a web survey, a paper survey, or an e-mail survey. In all but a few cases, those who responded preferred the web survey.

Entering Students

The questionnaire for entering students was administered to students registered in an introductory Computer Science course. This course was chosen because it is required for both MIS and Computer Science students and is usually taken in the first year of studies. Students taking the Computer Science course in the Fall 2000 and Spring 2001 semesters were asked via the class e-mail list and via personal visits to the class to fill out the survey on the web. They were given an information sheet about the survey, showing the address of the web survey, during the classroom visits. All students were given the option of filling out a paper survey, although none chose that option.

Exiting Students

The questionnaire for exiting students was given to students registered in two required capstone MIS courses. Students were contacted in the same way as the students in the Computer Science course. Several students filled out a paper version of the questionnaire. The survey was pretested in Fall 2000 and these four responses were included in the results. Exiting Computer Science students were not included.

IT Graduates

An e-mail was sent to the university's alumni mailing list asking IT graduates to fill out a survey on the web. A similar e-mail was sent to selected MIS students who had graduated within the last three years.

The response rate, summarized in Table 1, was only 7.5% for entering students, while the response rate for exiting students was 72.2%. The low response rate for entering students was possibly due to the low amount of contact with the students. Despite the paper reminder handed to them in class, students had to remember to access the survey later after class. There was only one e-mail reminder a day later. However, it should also be noted that not all students in this class intended to complete an IT degree. Some other programs require this course and other students take it out of interest.

TABLE 1
SAMPLE SIZE AND RESPONSE RATE

Targeted Group	Invitations to Respond Sent	Surveys Received	Response Rate (percent)
Entering Students	200	15	7.5
Exiting Students	54	39	72.2
IT Graduates	67+*	22	*unknown*

** In addition to these 67 graduates, there were an unknown number of IT graduates belonging to the university's 203-member alumni e mail list.*

Thus, the response rate from the intended population is higher than the figure shown.

The high response rate for exiting students was due to the support from the instructors, who gave their students several reminders to complete the survey. One instructor provided class time to administer paper surveys. The response rate for graduates is reasonable, given that there is no way of knowing how many would have received the e-mail request.

RESULTS AND DISCUSSION

Student Profile and Demographics

Because of the small number of surveys received from entering students, all the student surveys are combined in this study. Their education and degree aspirations are summarized in Table 2.

TABLE 2
STUDENTS' EDUCATION, DEGREE, AND MAJOR

	Percentage
Highest Achieved Education	
High School	48.1
Diploma	31.5
Bachelor's Degree	18.5
Degree Expected	
Bachelor of Management	64.8
Bachelor of Computer Science	24.1
Other	11.2
Major	
MIS	63.2
Computer Science	22.4
Other	14.2

The high percentage of students who already have a degree could be due to the job market and other factors. There were 54 student responses, 15 from first year students and 39 from third and fourth year students at the university. Of those responding to this question, 36 were male and 17 were female. The age range was from 18 to 44 (with an average of 25). The typical student who responded is working on a Bachelor of Management degree with a Management Information Systems major; expects to make from $40,000 - $45,000 CDN in the first job after graduation; expects to be working as an analyst, in database support, or in web design; and expects to be spending three to four hours a day working with people.

Graduate Profile and Demographics

There were 22 recent graduates who responded, 13 male and 9 female. They ranged in age from 23 to 43, averaging 29. Their education is summarized in Table 3.

TABLE 3
GRADUATES' DEGREE AND MAJOR

	Percentage
Degree	
Bachelor of Management	60.0
Bachelor of Computer Science	30.0
Other	10.0
Major	
MIS	61.2
Computer Science	22.4
Other	16.3

Graduates reported having taken anywhere from 5 to 30 IT courses, with an average of 15. Those reporting in the upper range presumably included courses taken after graduation, since the MIS major requires seven IT courses and the Computer Science major requires 13. There were 20 graduates working in the IT field while two were not. Those working in IT worked anywhere from one to more than five years in the field; their responses were fairly evenly spread out over the ranges given.

Sources of Knowledge About the Information Technology Market

Students were asked to rank the sources of knowledge about the job market that they used. Newspapers were the top source, followed by work term position postings, other job ads/postings, fellow students, professors, and IT contacts. No students chose job interviews or high school counselors as their number one source. Apparently students did not maintain contact with their high school counselors once they entered university. The Internet was not listed as an option, so "job ads and postings could include both general job and company web sites along with other sources. In contrast, graduates chose the Internet as the source they use most often, followed by job postings, newspapers, and IT contacts.

Knowledge and Skills Used in an Information Technology-Related Job

Students and graduates were given a list of 23 knowledge and skill items which were divided roughly into general skills (applicable to any job), specific IT knowledge and skills, and knowledge of how to use specific software packages. They were to rank each skill or knowledge on a 7-point scale as to its importance, with 7 being "extremely important and 1 being "not important at all.

General Knowledge and Skills

General knowledge and skills are seen by both students and graduates to be fundamental in information technology-related jobs. The vast majority ranked all of the general knowledge and skills as "important, "very important, or "extremely important. The most important of these skills was problem solving, chosen by 90.7% of students and 90.9% of graduates as extremely important or very important. The only statistically significant difference between students and graduates was that students rated teamwork as more important (at the 0.10 level using a t-test), perhaps reflecting the emphasis on teams in most of the courses.

IT Knowledge and Skills

Table 5 shows how students and graduates rated IT knowledge and skills. Both graduates and students felt that software development was the most important specific IT knowledge/skill, followed by systems design. They listed artificial intelligence and computer repair as not important at all or not very important. Graduates and students ranked IT knowledge and skills in approximately the same order, with students giving slightly more importance to each item than graduates. Students ranked installation/setup lower than graduates and end-user training higher than graduates. The only statistically significant difference was for artificial intelligence, at the 0.01 level, but this result is not very useful due to its low perceived importance by both groups.

Knowledge of Specific Software Packages

Table 6 shows that graduates and students both had similar rankings of software knowledge. The mean scores ranged from just under 4 ("somewhat important) to just under 6 ("very important). The highest mean for students was database knowledge (5.87) while database knowledge and operating systems tied for the highest mean for graduates, at 5.73. Students generally gave more importance to all of the software skills than graduates, but only graphics was statistically significant (0.01 level). However, most graduates and students felt that knowledge of graphics was not important at all or not very important.

University Teaching Effectiveness

Exiting students and graduates were asked to rate the university's teaching of the 23 knowledge and skill items identified above. They could choose any of seven

TABLE 4
RATINGS OF GENERAL KNOWLEDGE AND SKILLS

	Graduates		Students	
General Knowledge & Skills	**"Extremely Important" or "Very Important" (%)**	**Mean***	**"Extremely Important" or "Very Important" (%)**	**Mean***
Problem-solving	90.9	6.64	90.8	6.44
Communication	86.3	6.18	81.5	6.07
Interpersonal	63.6	5.77	81.5	6.02
Teamwork	59.1	5.77	83.3	6.20
Project management	50.0	5.45	68.5	5.91
Presentation	45.5	5.18	48.2	5.50

* 1-not important at all; 2-not very important; 3-only a little important; 4-somewhat important; 5-important; 6-very important; 7-extremely important

TABLE 5
RATINGS OF IT KNOWLEDGE AND SKILLS

	Graduates		Students	
IT Knowledge & Skills	**"Extremely Important" or "Very Important" (%)**	**Mean***	**"Extremely Important" or "Very Important"(%)**	**Mean***
Software development	63.7	5.73	75.9	5.93
Systems design	54.6	5.55	64.8	5.56
Testing	54.5	5.32	50.0	5.24
Database design	50.0	5.36	61.1	5.59
Network operating	36.4	5.05	46.3	5.35
Data modeling	31.8	5.09	50.0	5.39
Web development	31.8	5.09	44.5	5.06
Technical writing	27.3	4.73	37.1	4.93
Installation/set-up	27.3	4.64	16.7	4.83
End-user training	18.1	4.86	44.5	5.22
Computer repair	0.0	3.77	11.1	3.98
Artificial intelligence	0.0	3.09	11.2	4.06

* 1-not important at all; 2-not very important; 3-only a little important; 4-somewhat important; 5-important; 6-very important; 7-extremely important

TABLE 6
RATINGS OF SOFTWARE KNOWLEDGE

	Graduates		Students	
Knowledge of Specific Software Packages	**"Extremely Important" or "Very Important" (%)**	**Mean***	**"Extremely Important" or "Very Important" (%)**	**Mean***
Database	59.1	5.73	66.7	5.87
Operating systems	54.5	5.73	61.1	5.70
Internet applications	40.9	5.05	38.9	5.09
Standard software	36.4	5.09	48.1	5.44
Graphics/multimedia	9.0	3.68	22.2	4.69

* 1-not important at all; 2-not very important; 3-only a little important; 4-somewhat important; 5-important; 6-very important; 7-extremely important

responses for each item, from 1, "has not taught me anything to 7, "has taught me a great deal. The first year students were not given this question, as they did not have the experience to answer it.

General Skills

Only 40.9% of graduates and 46.2% of students felt the university taught them a great deal or a lot about problem solving. This percentage seems low, especially since problem solving was by far the most important skill identified by both groups. However, the means were 5.23 and 5.36 respectively for graduates and students. Graduates' scores were generally lower than students' scores, possibly because they have learned much more since they graduated. More students than graduates felt the university taught them a great deal or a lot about teamwork (69.3%), and the mean is significantly greater (0.02 level).

Specific IT Knowledge and Skills

Graduates and students felt the university taught them a great deal or a lot about database design, systems design, and database modeling. For all the other IT knowledge and skill items, most graduates and students felt the university did not teach them anything or very little. Only ratings for web design were statistically

TABLE 7
RATINGS OF GENERAL KNOWLEDGE AND SKILLS LEARNED

	Graduates		Students	
General Knowledge & Skills	"Has taught me a great deal" or "Has taught me a lot" (%)	Mean*	"Has taught me a great deal" or "Has taught me a lot" (%)	Mean*
Problem solving	40.9	5.23	46.2	5.36
Presentation	40.9	4.82	48.7	5.18
Teamwork	31.8	4.82	69.3	5.72
Communication	31.8	4.95	38.4	4.87
Project management	27.3	4.23	46.1	4.85
Interpersonal	24.7	4.23	23.0	4.49

* 1-has not taught me anything; 2-has taught me very little; 3-has taught me a little; 4-has taught me something; 5-has taught me a fair amount; 6-has taught me a lot; 7-has taught me a great deal

significant (0.01 level), probably reflecting changes in the curriculum made in recent years.

Knowledge of Specific Software Packages

Students felt the university did a good job teaching them database software, standard software, Internet applications, and graphics/multimedia. Graduates agreed the university did a good job teaching database software and standard software, but their ratings on Internet applications varied greatly (probably depending on their graduation date). Students and graduates felt the university did not do a good job teaching them operating systems, probably because university programs are generally limited to PC environments using one standard (currently Windows 98). The differences were statistically significant for graphics (0.10 level) and database software (0.02 level). Students rated these two areas higher than graduates.

Knowledge and Skills Needed vs Evaluation of University Teaching

Table 10 provides a framework for comparing the skills and knowledge needed to those which are taught. Of most interest are the four labeled corners:

1. The skill or knowledge is important, but the university did not teach much about it (attention needed).
2. The skill or knowledge is important and well taught (good).
3. The skill or knowledge was not important, and not taught (appropriate).
4. The skill or knowledge was not important, but was emphasized in teaching (wasted resources).

The skills and knowledge that exiting students and graduates considered the most important generally fell in area 2, i.e. problem solving, communication, teamwork, presentation, interpersonal, systems design, and database software. The two exceptions were software development and operating systems software, where the responses fell in areas 1, 2, and outside the four areas. This means there was not agreement among respondents as to importance and how well the university taught them.

Type of Work in First IT-Related Job

Students were asked to choose up to three job tasks that they expected to perform in their first IT-related job. They most frequently chose analyst (24), database support (22), and web design (19). End-user training and technical writing were the least frequently chosen responses.

Graduates were asked to check off as many job tasks as were contained in their current job. Analyst was the most frequently selected task (9), followed by software development (6), end-user training (6), and web design (6). Database was selected only once, suggesting that graduates do not start in that area as often as students suspect. The lack of students selecting help desk tasks is

TABLE 8
RATINGS OF IT KNOWLEDGE AND SKILLS LEARNED

	Graduates		**Students**	
IT Knowledge & Skills	**"Has taught me a great deal" or "Has taught me a lot" (%)**	**Mean**	**"Has taught me a great deal" or "Has taught me a lot" (%)**	**Mean**
Database design	40.9	4.86	51.3	5.26
Systems design	36.3	4.91	41.0	4.85
Database modeling	27.2	4.50	43.6	4.97
Software development	22.7	3.91	33.3	4.38
End-user training	22.7	3.45	20.5	3.74
Testing	4.5	2.95	2.6	2.79
Technical writing	4.5	2.95	15.4	3.69
Network operating systems	0.00	2.59	15.4	2.97
Web development	0.00	2.41	5.2	3.38
Artificial intelligence	0.00	2.18	5.1	2.46
Installation/set-up	0.00	2.14	0.00	2.18
Computer repair	0.00	1.59	0.00	1.59

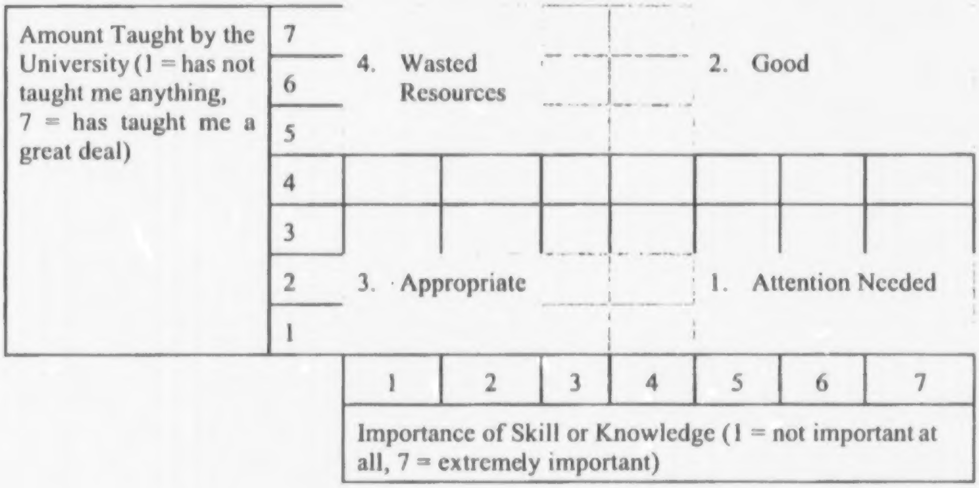
* 1-has not taught me anything; 2-has taught me very little; 3-has taught me a little; 4-has taught me something; 5-has taught me a fair amount; 6-has taught me a lot; 7-has taught me a great deal

TABLE 9
RATINGS OF SOFTWARE PACKAGES LEARNED

	Graduates		**Students**	
IT Knowledge & Skills	**"Has taught me a great deal" or "Has taught me a lot" (%)**	**Mean**	**"Has taught me a great deal" or "Has taught me a lot" (%)**	**Mean**
Internet applications	27.2	4.09	41.0	4.72
Standard software	22.7	4.55	48.7	5.18
Database	18.2	4.36	51.3	5.36
Graphics/multimedia	18.2	3.36	35.9	4.36
Operating systems	4.5	3.64	15.4	3.46

* 1-has not taught me anything; 2-has taught me very little; 3-has taught me a little; 4-has taught me something; 5-has taught me a fair amount; 6-has taught me a lot; 7-has taught me a great deal

TABLE 10
IMPORTANCE OF SKILL VS AMOUNT TAUGHT BY UNIVERSITY


Amount Taught by the University (1 = has not taught me anything, 7 = has taught me a great deal)
7
6
5
4
3
2
1
4. Wasted Resources
2. Good
3. Appropriate
1. Attention Needed
1
2
3
4
5
6
7
Importance of Skill or Knowledge (1 = not important at all, 7 = extremely important)

also interesting; while few want to work there it is a common entry point.

Expected Salary

Students were asked how much they expected to make in their first IT-related job after graduation. The students' responses were clustered around the three middle ranges, from $30,000 to $44,999 CDN. Graduates were asked how much IT graduates should make in their first job after graduation. The majority chose $35,000 to $39,999 CDN. Mean salary expectations showed a downward trend from entering students ($40,625), to exiting students ($37,434), to graduates ($34,772). This could be related to their increasing experience as they progressed through their university program and then joined the work force.

Graduates were asked if salaries in general met with their expectations. They reported that actual salaries were about the same as they expected or less than they expected.

TABLE 11
GRADUATES' SALARY EXPECTATIONS

Salary Expectations	No. of Responses
Actual salaries the same as expected	9
Actual salaries less than expected	7
Actual salaries more than expected	4
Don't know	2

CONCLUSIONS

This study showed a surprising level of consistency between the reality, as represented by recent graduates, and the expectations of students. Students recognized the importance of general skills in entry-level jobs and placed the highest importance on problem solving skills. General knowledge and skills, such as problem solving, communication, interpersonal skills, and teamwork, continue to be important in entry-level IT jobs. Software skills are also important, such as knowledge of operating systems and database applications. One area of difference was that students had higher salary expectations than graduates.

Students and graduates felt the university is doing a good job teaching them the general skills. However, their perception was that the university did not do as well teaching them IT knowledge and skills. Whether or not this is true, the instructors of IT courses have an opportunity to tell students about the IT skills they are teaching and how they will fit into their careers, over both the short term and long term.

The information technology field is growing and changing and information technology curriculum remains a moving target for educators. A continuing survey of IT graduates of the university would give a more accurate picture of the trends. What kind of jobs are they competing for and what kind of jobs are they getting? What skills and knowledge are important at different times in their careers? Such a long-term study would give university faculty up-to-date information about the marketplace and they would be in a good position to develop a solid IT curriculum and to create linkages with employers. Employers would have access to better trained employees over the long term and would have better knowledge of graduates' skills and knowledge.

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APPENDIX
SURVEY OF INFORMATION TECHNOLOGY STUDENTS
ENTERING STUDENTS

You are asked to complete and return this survey. The information from the survey will enable me to learn more about the students who choose Information Technology (IT) majors at the University of Lethbridge. Participation in the survey is voluntary and your responses will be kept strictly confidential. Your ID number will be used only to ensure each completed questionnaire is unique, and will be strippedfrom the questionnaire once all the responses have been received. The information will be reported in general terms without specific reference to individual responses.

If you have any problems with this form, please e-mail hodd@uleth.ca

ID Number: ______________________

1. What sources do you use to find information about the Information Technology (IT) market? Rank each source you use.

_____ Professors
_____ Fellow students
_____ Job interviews
_____ Job ads and postings
_____ Co-op position
_____ Contact(s) in the IT industry
_____ Newspapers, magazine articles, on-line articles
_____ High school counselors
_____ Other specify ______________________

2. How much do you know about the MIS major (Bachelor of Management program)? Place an X beside the appropriate answer.

	I know nothing about it
	I know almost nothing about it
	I know very little about it
	I know a little about it
	I know something about it
	I know a fair amount about it
	I know a lot about it

3. How much do you know about the Computer Science major (Bachelor of Science program)? Place an X beside the appropriate answer.

	I know nothing about it
	I know almost nothing about it
	I know very little about it
	I know a little about it
	I know something about it
	I know a fair amount about it
	I know a lot about it

4. Knowledge and skills that you might use in an Information Technology-related job are listed below. How important do you think each will be for your first IT-related job after graduation? Write a number beside each item to indicate its importance.

1	2	3	4	5	6	7
not important at all	**not very important**	**only a little important**	**somewhat important**	**important**	**very important**	**extremely important**

______ communication skills (oral & written)
______ interpersonal skills
______ presentation skills
______ problem-solving
______ team work
______ project management
______ technical writing
______ end-user training
______ artificial intelligence
______ computer repair
______ data modeling
______ database design
______ network operating systems
______ systems design
______ software and hardware testing
______ software and hardware installation and set-up
______ web development (e.g. html, JavaScript, vbscript, PERL, or Active X)
______ software development (e.g. Java, Visual Basic, MS Access, or Visual C/C++)
______ knowledge of operating systems (e.g. DOS, Windows, Unix, or Linux)
______ basic knowledge of standard software (e.g. word processing, spreadsheet, or presentation)
______ knowledge of internet applications (e.g. Netscape, Internet Explorer, or Front Page)
______ knowledge of graphics and multimedia applications (e.g. Paint Shop Pro, Adobe Photoshop, or Adobe Illustrator)
______ knowledge of databases (e.g. MS Access, or Oracle)

5. In any job, you will spend some time working at the computer on your own and some time interacting with people (conferring with your workmates, attending meetings, and talking on the telephone). How many hours per day on average do you expect to spend interacting with people in your first IT-related job? Choose one response.

____ less than 1 hour ____ 1 - 2 hours ____ 3 - 4 hours ____ 5 - 6 hours ____more than 7 hours

6. What type of work do you expect to be doing as your primary task in your first IT-related job? Choose up to three items.

______ analyst
______ database design
______ data modeling
______ database support
______ network maintenance and installation
______ software design
______ software development
______ testing
______ technical writing
______ end-user training
______ user support/help desk
______ web design

7. What salary do you expect to receive in your first IT-related job after graduation (in $ CDN)?

____ $20,000 - $24,999
____ $25,000 - $29,999
____ $30,000 - $34,999
____ $35,000 - $39,999
____ $40,000 - $44,999
____ $45,000 - $49,999
____ $50,000 and above

Demographic Information

8. Sex ____ M ____ F

9. Age ______

10. Highest level of education achieved to date:

____ High School Diploma ____ College Certificate ____ College Diploma
____ Bachelor's Degree ____ Master's Degree

11. What degree(s) do you expect to receive when you graduate in your currently registered program?

____ Bachelor of Management ____ Bachelor of Education
____ Bachelor of Science ____ Bachelor of Arts
____ combined degree in Management and Education ____ combined degree in Arts and Management
____ combined degree in Science and Management ____ other

If you checked "other above, what degree/diploma/certificate will you receive when you graduate? ________________________________

12. What is your first major? ________________________________

13. How many courses do you have left until you graduate, not including the current semester? (Do not count co-op work terms.)

____

14. How many courses have you taken already, including the current semester? (Include courses taken at other colleges and universities and exclude co-op work terms.)

____

15. How many IT-related courses have you taken so far, including the current semester? (Include IT courses taken at other colleges and universities and exclude co-op work terms.)

____

Thank you for your help!

Paper survey: Please return the survey in University of Lethbridge intercampus mail to:

Pat Hodd
Room E-480, Faculty of Management
The University of Lethbridge
4401 University Drive
Lethbridge, AB T1K 3M4

Web survey: Fill in the survey found at http://home.uleth.ca/~hodd/ITstudents/survey1/ and click on the "Submit button.

If you would like to receive the results of this survey, they will be posted on the following web site:
http://home.uleth.ca/~hodd/ITstudents

STUDENTS ASSESSMENT IN PBL SETTING FOR INFORMATION SYSTEMS COURSES

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North Georgia College & State University

Willie Yip
The Hong Kong Polytechnic University

ABSTRACT

The application of Problem Based Learning (PBL) approach to learning and teaching is becoming more and more popular in many areas of professional Education including Medicine, Chemistry, Biology, Law, and Business Administration. Recently some teachers in the area of Information Systems education began to use this strategy. One of the major problems and concerns of both educators and students in the PBL setting is the assessment of student' work. In this paper, the authors have followed up their previous work and present their approach to students' assessment in the information systems courses. In our approach, we measure several students' skills such as critical thinking, communication skills and so forth as well as doing some traditional assessment such as tests and quizzes with a lower percentage than traditional. Students' perceptions of our assessment strategy have been evaluated through the end of semester survey. It is the authors' plan to make the assessment strategy more general with the hope that other instructors are able to use it in their own courses. The authors have taught an information system course in their respective institutions using PBL as a teaching strategy as well as applying the assessment strategy to assess students' work. The outcome of the application of PBL, the assessment strategy, and students' perception of PBL assessment are presented in this paper.

INTRODUCTION

Problem-based learning (PBL) is an educational strategy that uses problems as the starting point for student learning (Bligh, 1995). It is a curriculum design and teaching/learning strategy, which recognizes the need to develop problem-solving skills as well as the necessity of helping students to acquire the necessary knowledge and skills (Boud & Feletti, 1997; Biggs 1999). The main issue is to reduce direct instruction as students assume greater responsibility for their own learning. Students are given ill-structured problems through which they develop high-order thinking and problem-solving skills. The shift in the teaching and learning process is more student-centered than teacher-centered. The role of the teacher is to encourage student participation, provide guidance to students, offer timely feedback, and assume the role of learner as well (Aspy et al., 1993). Evidence of the success of problem-based learning as an instructional strategy is strongly positive, particularly in fostering increased knowledge retention (Norman & Schmidt, 1992), encouraging general problem-solving skills, for deep-biased students (Norman & Schmidt, 1992; Lai, Tiwari & Tse, 1997), promoting self-directed learning skills, and increasing intrinsic interest in the subject matter. Since its introduction as an instructional method used in the medical school at McMaster University in Ontario in the 1960s, PBL has spread to numerous educational institutions around the world. To the best of our knowledge, the PBL strategy has not become so popular in the field of computer science and information systems. We have applied the methodology to our respective institutions for the last couple of years and it proved to be successful. The course that we have applied is Systems Analysis and Design. However, students' assessment often proves to be difficult for teachers. The traditional assessment using multiple choice or true and false tests do not seem to be suitable for PBL approach to teaching. As students work in teams, there is concern of assessing their contribution in teamwork and individual performance, as well as other skills. That is why assessment instrument need to be created for PBL approach.

Woods (1996) presents 16 issues related to PBL assessment. His suggestion is more of theoretical ideas about measuring students learning process. There are no specific guidelines on the way that some or all of these issues can be applied in practice. They are all based on Bloom's taxonomy (1956). It is not clear whether we should develop separate criteria for PBL assessment, use traditional tests and quizzes, or a combination of both.

Newak and plucker (1999) suggest that the PBL instruction and assessment should be aligned. They proposed four suggestions for this alignment. Motivate students, create hands-on-learning environment, provide reasonable guidelines, and model real-world behavior.

Hicks (1998) suggests that PBL assessment at times can be a formidable task but can be done in different forms such as teachers observation, written material and products, peer evaluation, self-evaluation, and feedback from the outside community.

The subject of this paper is the application of the authors' PBL assessment instrument that has been developed in their previous paper. This instrument contains a set of criteria that are focused in nine different areas namely, Individual work, Teamwork, Creative Thinking, Analytical Skills, Communications skills, Leadership skills, and course assessment. Students' perceptions of this assessment have been performed through regular end of semester survey and the results proved to be very favorable. The students of the two institutions have marginally different perceptions with regard to PBL assessment. Nevertheless, the majority of our respective students favor our assessment as opposed to traditional assessment. In the following sections we present the details of the assessment strategy.

THE ADOPTED PBL STRATEGY

When adopting the PBL strategy for teaching, assessment of students work is one of the major concerns. Why is assessment important? Assessment can drive students to work. Also, students learn what is assessed (Woods 1996.) In an attempt to solve this problem, the authors have developed an assessment instrument for the information systems courses, specifically Systems Analysis and Design and then applied the instrument in their respective institutions. In deciding what to assess students using PBL approach to learning and teaching, we posed the question, initially, of what should be the qualities of IS graduates and we considered the following skills that graduates should be able to:

1. Work independently
2. Work teams
3. Think critically in problem-solving
4. Have analytical thinking
5. Communicate (both oral and written)
6. Have leadership potential

We believe using these skills as assessment of student work is much more effective than requiring them to memorize the lecture topics, take tests, and later forget about them what they have learnt. However, we have attempted to address the above skills as follows.

1. In the PBL setting students are generally given a problem to solve. In the case of Systems Analysis and Design they are given a problem to analyze and design. The problem is not well defined. In another word, the detail of the specification is not provided to the students. As a result students must choose their own way of learning and to come up with a solution strategy for the problem. For example, they may read their books, search the Internet, go to the library and read some other books or periodicals. All these activities are designed to develop positive attitude towards learning, organize their work and behave professionally.

2. Every IS professional needs to be compatible with people. Teamwork is an important part of the IS profession. Students need to be trained to respect and listen to other people's opinions. In teamwork situation, they need to distribute work fairly among the team members. Students need to attend group meetings and meeting the project's deadline. In addition students develop some ethical behavior.

3. Critical thinking is a state of mind that is not achieved automatically. Students must be trained. Students must be trained to think critically towards solving a problem. We believe that PBL strategy can help students to gain critical thinking skills. This activity is designed for students to propose creative

ideas, viewing at other people's work critically and justify their solutions, which in turn help them to stretch their mental ability.

4. Students need to possess analytical and problem-solving ability. In many situations students are required to discuss and cope with ambiguous problems. In this activity students will practice and learn approaches to redefinition of their problem in an understandable manner. They learn how to approach in solving a problem. For example, decomposing the problem into pieces and assign each piece to one of the team members. At their next meeting they share their solution with each other.

5. Communication is another skill that is very important for an IS professional. There are many levels of communications namely; communications with team members, communication with project manager, and communication with clients. In addition, in this activity students will also practice written communications through their project submission and also oral communication by presentation their projects. As a result students will develop communication skills.

6. Leadership is an, integral part of IS professional. The project leader is responsible to meet the deadline, to monitor and control the project, decision-making, and so forth. In the traditional teaching, students hardly have a chance to practice these issues whereas in the PBL setting due to its nature the leader must control the project.

STUDENTS' WORK ASSESSMENT IN THE PBL SETTING

In this section we will explain the details of the application of assessment instrument in our courses. Basically the assessment of students' work was done in three steps as described below.

Step 1

In this step we followed their learning process very closely throughout the course. The students' work in each project phase has been monitored and compared with the previous phase. This is to ensure that the work will be good quality though out. We are also concerned that they can integrate knowledge to practice and their reports have been written and presented in a professional manner. Should students' work are in need of changes or modifications, they will be informed with recommendations and suggestions to resubmit their work. In this step we do actually more than just grading of the students work, students have a chance of reflecting on their work performance.

Step 2

In this step the evaluation is done based on the students report of each phase of their project. The following is a list of the items that students are required to submit along with their projects.

- Log of their work
- Amount of time spent reading books and the page numbers that they read
- Amount of time spent working on the internet, submitting the URL they used and the subject they studied
- Amount of time spent communicating with team members
- Amount of time spent on meeting for a particular phase of the project including the topic that was discussed on that meeting
- Problems that they were encountered during the meeting
- Peer review for each of the project
- For presentation of their project we measured
  - Quality of their presentation
  - Use of time
  - Eye contact
  - Use of visual aid
  - Answer to questions
  - Fluency of the topics being related to each other
  - Confidence on the subject matter

Step 3

To accommodate the needs of students with different learning styles we also performed some traditional assessment through tests and quizzes. The percentage of this component is about thirty percent of their total grade. Some of the students who were willing to work but were having difficulties in their project through PBL strategy could focus on this aspect of evaluation. The other reason for having traditional assessment component is the following. Students are used to traditional assessment all their study life in many other courses. Suddenly changing that habit in our courses make them feel uncomfortable and are concerned about their grade. Adding this component will reduce this anxiety.

STUDENTS' PERCEPTION OF THE PBL ASSESSMENT

In Fall 2000 the authors both applied the PBL strategy in their Systems Analysis and Design courses. The PBL assessment instrument that we developed and was presented in the last section have also been applied to our their respective courses. We found this experience very motivating to students and instructors. The most interesting part was the students' interaction with each other through team meetings and other ways of communications. To see students' perception of our approach we conducted an end of the semester survey concentrating on different learning issues as compared with traditional teaching methods. A total of 46 questions were asked in the survey addressing different issues in the course. The survey results are depicted in the following charts.

FIGURE 1
WRITTEN TESTS AND QUIZZES

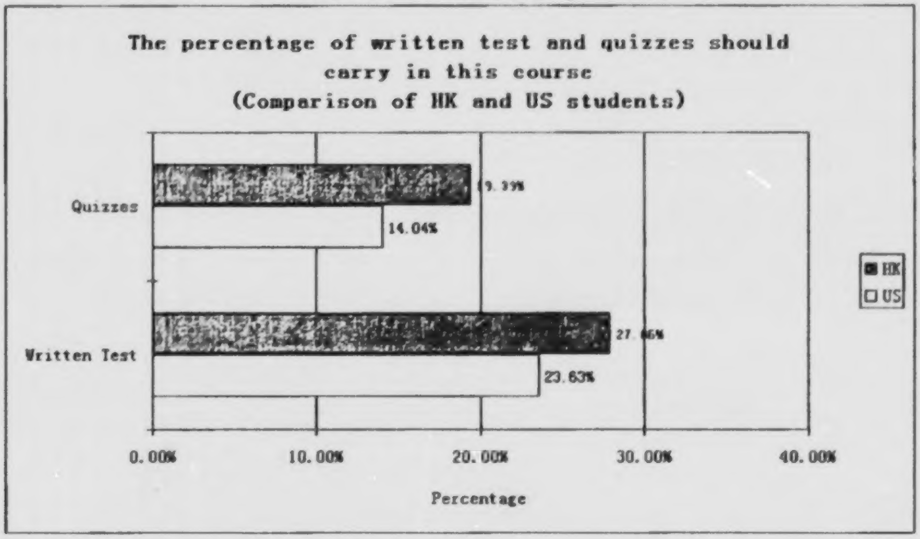


FIGURE 2
INDIVIDUAL WORK

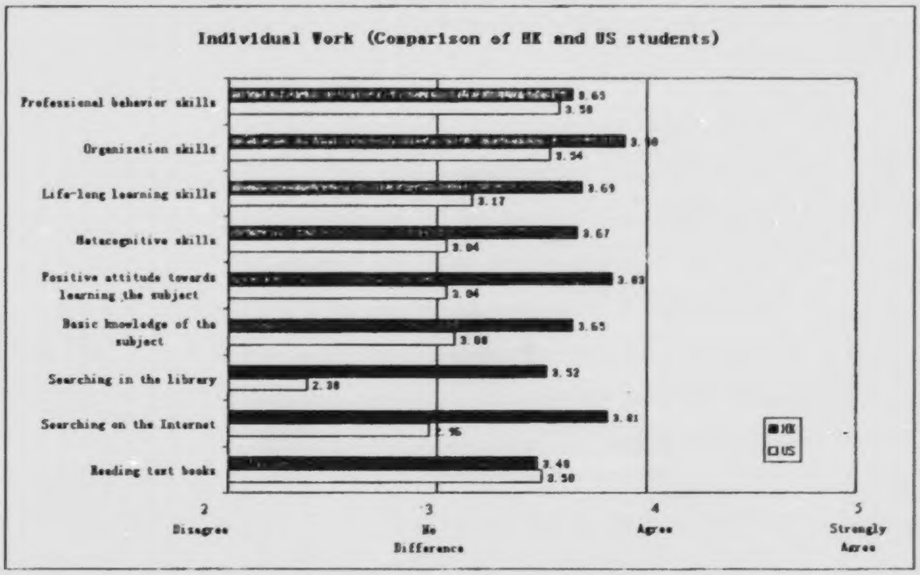


FIGURE 3
TEAMWORK

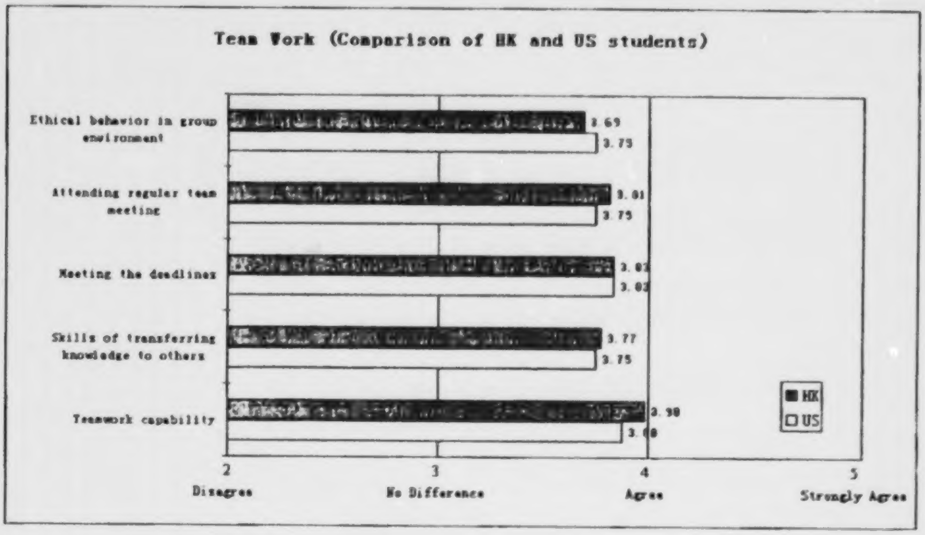


FIGURE 4
CREATIVE THINKING

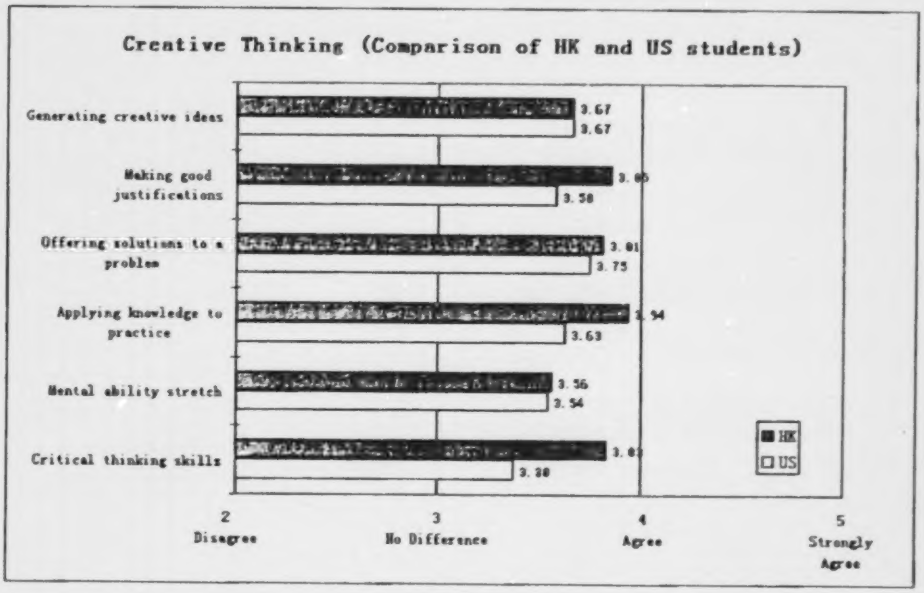


FIGURE 5
ANALYTICAL SKILLS

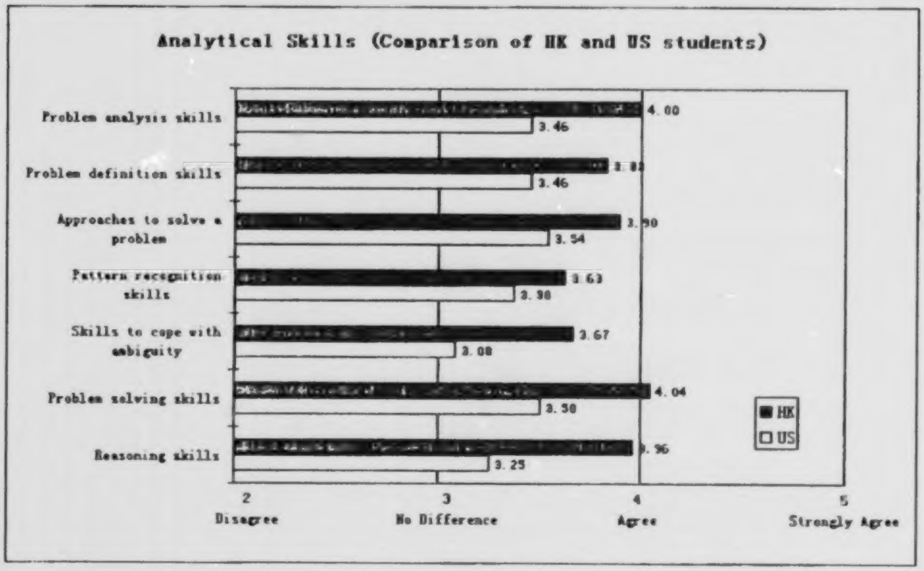


FIGURE 6
COMMUNICATION SKILLS

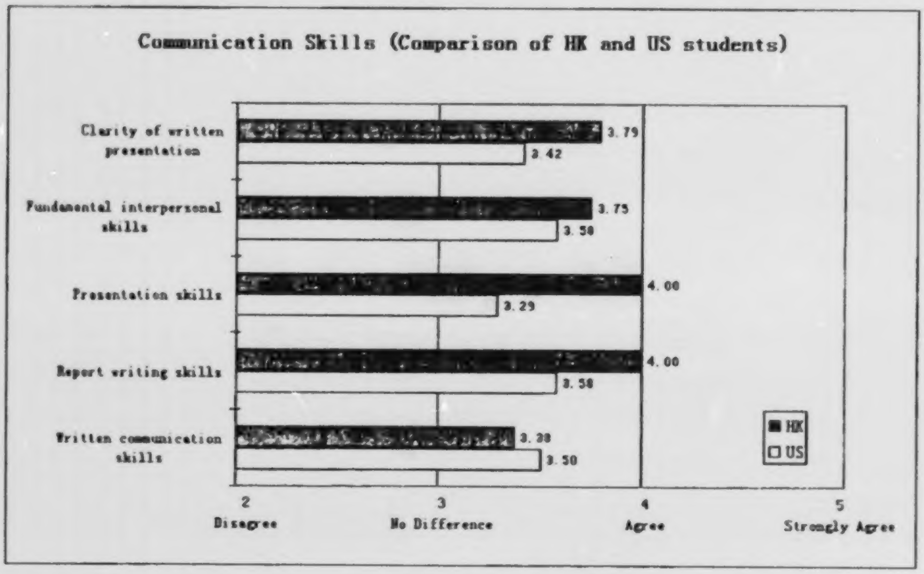


FIGURE 7
LEADERSHIP SKILLS

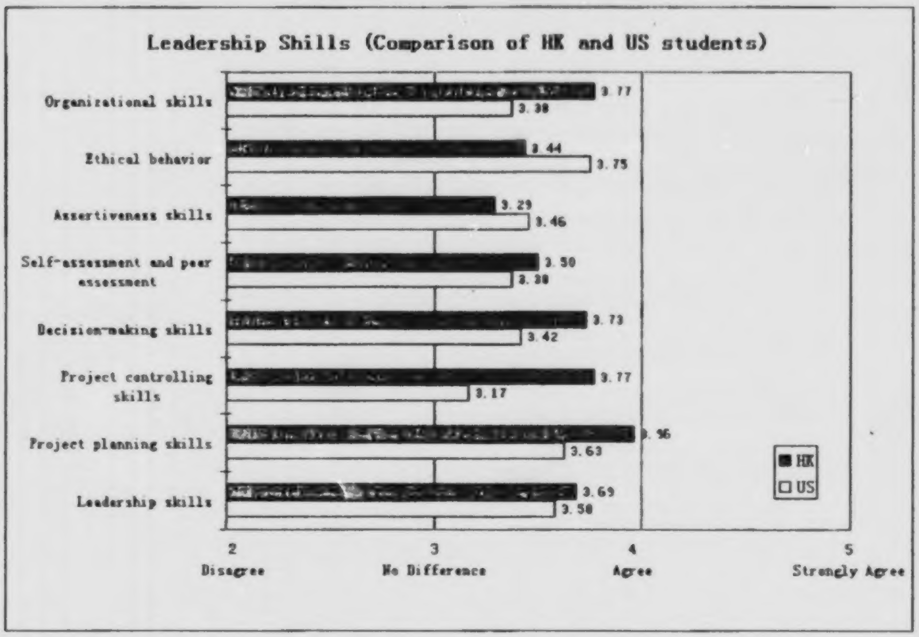
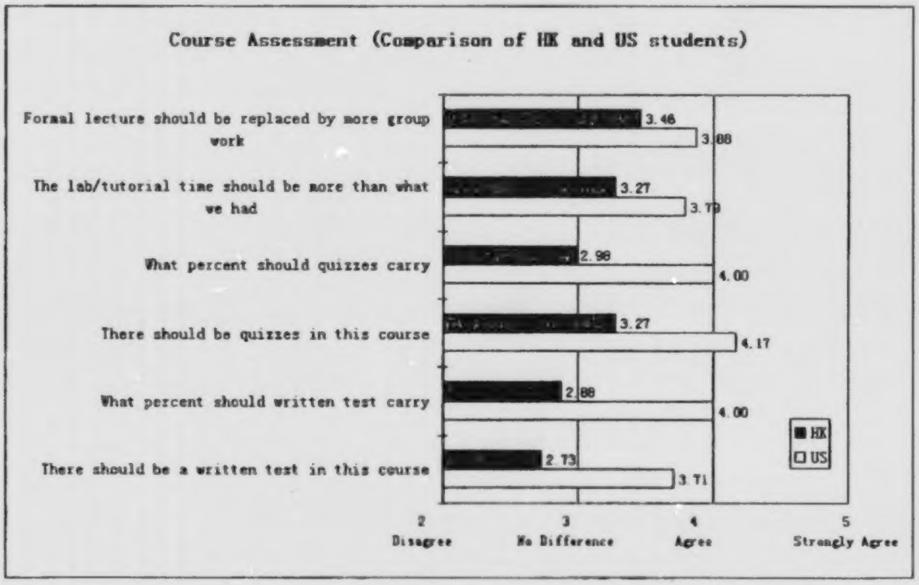


FIGURE 8
COURSE ASSESSMENTS



ANALYSIS OF THE RESULTS

The charts depicted above demonstrate that the majority of students in both institutions agree that, in the PBL settings, they have developed skills far beyond what they would have done in traditional teaching settings. However, there are significant discrepancies in certain areas. For example, Use of library, searching on the Internet, life-long learning, and positive attitude towards learning skills developments are rated lower for the US students compared with the students in Hong Kong school of our study, see Figure 2.

Students in Hong Kong school seem to be more comfortable with PBL setting than the US students. This is reflected in their ranking of PBL assessment verses traditional assessment. The US students want more percentage for formal test and quizzes (average of 25 percent). Whereas the Hong Kong students want lower percentage for formal tests and quizzes (average of 18 percent.) see Figure 1 and Figure 8. This reflects that students in Hong Kong are more comfortable with PBL strategy and our assessment mechanism. This is due to the fact that the PBL strategy is more popular in the Hong Kong school.

Nevertheless our observation is an isolated study for two schools only. More formal studies are required to draw a general conclusion. However, our study proves that students in PBL strategy and its subsequent assessment are far more professionally active than when the traditional teaching is applied. Some of these activities include, commitment to teamwork and its responsibilities (See Figure 3), creative thinking (see Figure 4), analytical skills (see figure 5), communications at different levels see Figure 6), and taking charge of the learning process instead of relying too much on the instructor (see Figure 7).

CONCLUSION

Evaluation of students' achievement is an important aspect of education, and the skills required inherent in the process of solving real-world problems must be included in that assessment. The authors believe that alignment of instruction and assessment is essential when the PBL strategy is applied to our courses. In this study we focused on the generic ability of the IS graduates. The assessment instrument proved to be successful in many ways. It had significantly reduced students' anxiety with regard to accuracy and methodology of assessment. It has created a relatively fair and easy to use methodology of assessment, which is the major concern of both students and instructors who apply the PBL strategy in their courses. The assessment works best for the courses that we have applied. This is because the organization of keeping the log of your work on a daily basis is part of the task that systems analysts and software developers do in practice. The PBL strategy had several positive results that are worth noticing. The rate of students learning activities including, reading, searching, and communication was much higher compared to the traditional teaching and assessment for the same courses.

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COMPARISON OF LIVE VERSUS PAPER-BASED ASSESSMENT IN COMPUTER APPLICATION COURSES

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ABSTRACT

This paper reports findings from a study on using computer-based assessment (CBA) in a university course. Data gathering took place over two semesters and includes findings from over 130 students and three faculty members. The CBA tool used was an application-based testing product that measures students' proficiency in computer applications such as Microsoft Word, Excel, Access and PowerPoint 2000, while working live in the actual program application. The product, SAM2000 (Skills Assessment Manager) allows students to perform real-world tasks in a "live" testing environment. Data for this project was gathered through (1) questionnaires completed by students which evaluated their experiences and reactions to the computer-based tests as assessment tool including perceptions on ease of use, fairness of grading, perceived impartiality, perceived difficulty, and perceived level of performance; (2) informal interviews with faculty that administer computer-assisted tests to determine their perceptions of using this medium for testing—both advantages and disadvantages; and (3) analysis of student test scores in both conventional paper-based tests and computer-based assessments.

INTRODUCTION

The rapid growth of information technology is changing the way the world does business. Similarly, it is changing the way teaching and learning take place. As such, institutions of higher education must use technology in the presentation of course content and the assessment of academic abilities. Computer-based assessment (CBA) is becoming an essential component to higher education.

Computers are used in every aspect of our lives, particularly in the business world. Since college students will no doubt be using computers in their careers, there is no question that course content should be taught using technology and computers. Therefore, assessment should be based on the same concepts and should be tested in the environment in which the concepts are used. CBA is becoming an essential component to higher education. Furthermore, computers are being used to conduct large-scale graduate placement tests, such as the Graduate Record Examination (GRE) and the Graduate Management Admission Test (GMAT), professional certification exams, such as the Series Seven exam, vocational interest and aptitude assessments, and workplace skills tests. With such high-stake exams being offered on computers, students will be taking tests using this medium and faculty members need to prepare them.

Computer-assisted testing provides a tool for formal assessment of large groups of students without overburdening teaching staff with test-grading responsibilities (Zakrzewski and Bull, 1998). If we expand to include the area of distance education where entire courses are delivered remotely via technologies such as course websites, e-mail, Listservs, bulletin boards, and/or videos, it is imperative that assessment can be delivered remotely via computer-based testing.

Given the importance of technology for assessment, various studies on implementing computer-based assessment have been conducted. Primarily, these studies focus on particular software packages used for delivering and grading "short-answer" exams with a computer. Some studies are based on implementations in elementary and middle schools (Russell, 1999) while others studies focus on higher education (Bocij and Greasley, 1999 and Zakrzewski and Bull, 1998). Cutshall (2001) provides a discussion on implementing various formats of CBA in career and technical education environments. Thelwall (1999) provides an overview of the types of CBA tools. In particular, Thelwall discusses the benefits of implementing "random-based tests" where a set number of questions are randomly selected and administered to an examinee from a large test bank of questions.

This paper focuses on a study to assess the effectiveness of using "live" performance-based assessment in an undergraduate computer applications course. The overall goal of the research is to identify the impact of using live-in-the-application (live) testing software on student performance. Our primary goal is to evaluate if live testing is more valid and reliable than traditional testing methods. In addition, we are interested in investigating both student and faculty acceptance of live testing in place of traditional paper-based assessment.

Sam 2000, the CBA tool selected for this project, measures students' proficiency in Microsoft Office 2000 including Microsoft Word, Excel, Access, and PowerPoint while working live in the actual program application. The CBA automatically grades the students' responses based on the specific methods required to obtain the desired results.

For the purpose of this project, we define the traditional paper-based assessment technique as a paper test consisting of instructions to complete a series of tasks while working in the actual software application being evaluated. Students are graded on their final product, not on the specific methods used to obtain the desired results.

DATA GATHERING

This study was conducted over two academic semesters in multiple sections of an introductory computer applications course. All of the students in the study were administered two tests evaluating their proficiency in Microsoft Excel 2000. The first test was administered via Sam 2000; the second test was a comparable paper-based test assessing the same skills as the computer-based test. Scores for both tests were recorded and the students were given a follow-up questionnaire to evaluate their experiences using both mediums, particularly the CBA technique. Data for this project was gathered through:

Recording Student Perceptions of Using Computer Based Assessments

- participant observations
- post-test survey
- informal interviews following CBA

Recording of Student Background Information

- background questionnaire items related to educational background, familiarity with computers, and experience with computer based examinations

Recording Faculty Perceptions of CBA

- informal interviews with faculty who administer computer-assisted tests to determine their perceptions of using this medium for testing—both advantages and disadvantages

Recording of Examination and Assessment Results

- direct capture by the CBA
- analysis of detailed student performance reports generated by the CBA
- analysis of student test scores to compare performance between traditional paper-based tests and computer-based assessments

CBA Software Description

This research focuses on one type of CBA within the family of skills-based testing software. Skills-based products either test "live-in-the-application" or simulate the application environment. In both product groups, examinees are evaluated on their ability to perform specific tasks in the application being tested. In selecting the specific program used in this study, we evaluated several programs within this family, the majority of which were simulated. We selected SAM 2000 (Skills Assessment Manager), available through Course Technology (www.course.com), which allows students to perform real-world tasks in a "live" testing environment.

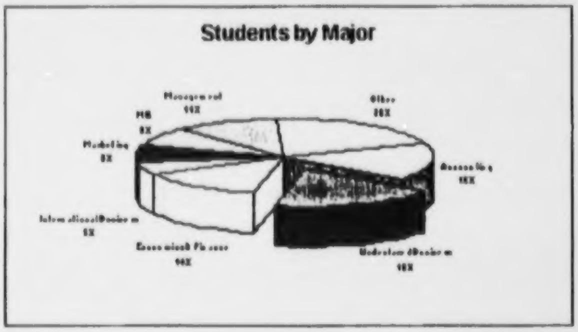
SAM 2000 tests the user's proficiency while the user works live in the application. For example, when a user is tested on formatting text in Microsoft Excel 2000, the user completes exactly the same steps they would if formatting the text outside the SAM 2000 environment. An instructor creates an exam to test skill proficiency in a specific application (e.g., Microsoft Word, Microsoft Excel, etc.). Questions are selected by the instructor based upon the particular skills that they want to test. When students take a SAM 2000 exam, each skill-based question is presented individually; students have the opportunity to redo any question on the exam provided that the allotted exam time has not expired. Upon completion of an exam, students are presented with reports on both their overall performance and detailed information on specific skills that were completed incorrectly with reference to related sections of their text.

Study Group

This study focuses on incorporating CBA techniques into an undergraduate computer skills course in the School of Business at Montclair State University, a regional four-year institution in northern New Jersey. The Computers in Business course is a required course for all undergraduate majors in the School of Business. The course is divided into three modules as follows: Module 1—Word 2000; Module 2—Excel 2000; and Module 3—Access 2000. Our study, conducted over two semesters, examines eight sections of this course including both day and evening sections; three different instructors taught these sections. All sections selected for the study followed a similar syllabus, administrated comparable examinations, and received the same number of contact hours.

A total of 133 students participated in the study—70 students in the Fall 2000 semester and 63 students in the Spring 2001 semester. Of these students, there are 22 freshmen, 45 sophomores, 48 juniors, and 18 seniors. Of them, 88% (116) are full-time students and 12% (17) are part-time students. The breakdown by student's major is found in Figure 1.

FIGURE 1
BREAKDOWN OF STUDENTS
IN THE STUDY BY MAJOR



Of the 133 students in the study, 91 of the students have never taken an exam on a computer prior to enrolling in the Computers in Business course. The remaining 42 students had taken at least one exam on a computer in high school or college, or has taken a standardized educational test such as the GRE.

Construction of CBA and Paper-based Examinations

During the course of the semester, each student had multiple exposures to taking CBA. Students' first experience with the CBA was in the form of a three (3) question practice exam. This exam did not contribute towards the student's course grade and students had the opportunity to take the practice exam multiple times to ensure that they were comfortable navigating the CBA environment. Instructors were available to address any technical problems and observe the reaction of students to the CBA environment. The next exposure to the CBA was their Module 1 examination covering Microsoft Word 2000 tasks; this exam was scored and contributed toward the student's final grade. The CBA results reported in this study are derived from Module 2 examination covering Microsoft Excel 2000 tasks. The Excel CBA exam was constructed by choosing twenty-five (25) questions related to skills learned in class during Module 2. The exam was created using an iterative process and involved instructors from all sections included in the study.

Student's scores on the CBA were automatically recorded. Data recorded by the CBA includes overall score achieved, question-by-question performance analysis, and elapsed testing time. Grades on the CBA are based solely on the student's ability to complete a specific skill-based operation in the application; in this case, the students are tested on Microsoft Excel skills. There are multiple ways in which each question can be answered and scored correctly; for instance, if a student is asked to make a title bold they can use keyboard shortcuts, the edit menu, or the toolbar to complete the task. There is no partial credit on the CBA.

The paper-based examination was constructed to mirror the tasks tested in the CBA. As in the case of the CBA, the paper-based exam was created using an iterative process and involved instructors from all sections included in the study. Questions on the paper-based exam were phrased in a similar manner to those on the CBA. Each question on the paper-based exam directs the student to perform a task in Microsoft Excel. Students could perform tasks in any order and could revise their answers at any time provided that the examination is completed within the time limit.

The paper-based examination was graded manually by viewing the printout and actual Excel file containing the completed examination. Results of the paper-based exam were recorded by physically checking exam responses and noting the required information in an Excel spreadsheet. Grades on the paper-based examination are based on the final product submitted by each student, as opposed to how each task was performed. For example, a student could be asked to insert text in a cell using the Copy and Paste functions— in the paper based exam the instructor would grade the student based on the appearance of the correct text in the correct cell rather than on HOW the text was inserted in the cell—on the CBA the student would be graded on HOW they inserted the text not on it appearance. Partial credit was awarded on the paper-based exam.

RESULTS

Student Perceptions

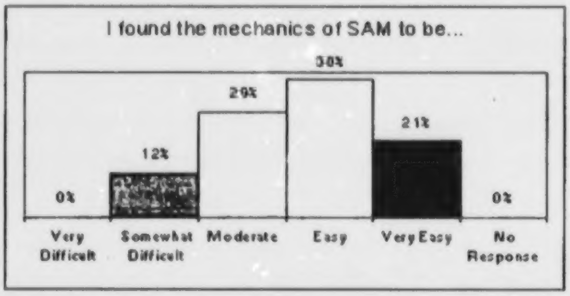
A post-examination survey was used to gather information concerning students' experiences using computer-based assessment software. Questionnaires were adapted from existing sources such as Miller and Engemann (2000) or Bocij and Greasley (1999) in order to improve validity and reliability.

All data collected was prepared for analysis with spreadsheets and statistical packages. Eight questions were administered to examine student attitudes and perceptions toward computer-based assessment. The summaries that follow are based upon all student responses, participant observations, and informal interviews with students.

The first question evaluated students' comfort with using the software.

Ease of use. Students evaluated the ease of use in navigating the Sam 2000 software environment. Students rated the difficulty level of the mechanics of accessing SAM, taking the exam, and reviewing the exam results. As shown in Figure 2, the majority of the students (59%) found the software to be easy or very easy to use. While 29% found it to be moderate and only 12% found the software to be somewhat difficult to use.

FIGURE 2
EASE OF USE



By the time the surveys were completed the students had several experiences with the software. For the most part, students found the exam interface to be straightforward and user-friendly.

The next pair of questions evaluated the quality of Sam 2000 as an assessment tool by considering the range of knowledge assessed by this computerized examination process and the difficulty of the exam.

Range of skills. This question asked students to compare the range of knowledge and skills assessed by the computer-based testing with actual course content. Figure 3 displays that the majority (76%) of the

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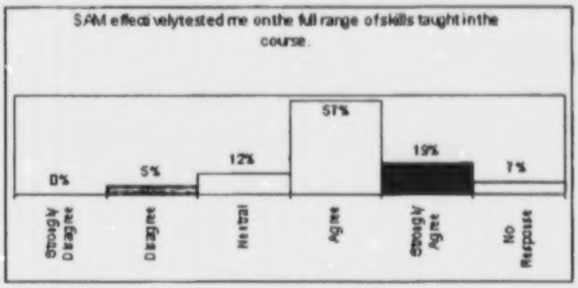
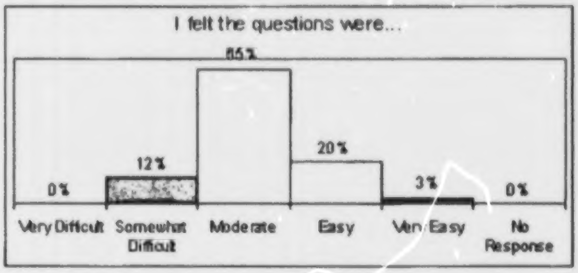
respondents found that SAM effectively tested the full range of skills taught in the course. Nineteen percent of the respondents felt neutral or did not respond to the question. Only 5% of the respondents did not feel that the test effectively tested all the skills taught. A number of the students who disagreed with the statement indicated that they were not tested on *all* the skills presented in the class. None of the students indicated that they were evaluated on skills that had not been taught.

FIGURE 3
RANGE OF SKILLS



Question difficulty. Students evaluated the difficulty of test questions on the Sam 2000 exam. Figure 4 demonstrates that the large majority of the students (65%) felt that the questions were moderate, while 23% of the students found the questions to be either easy or very easy and 12% found the questions somewhat difficult.

FIGURE 4
QUESTION DIFFICULTY

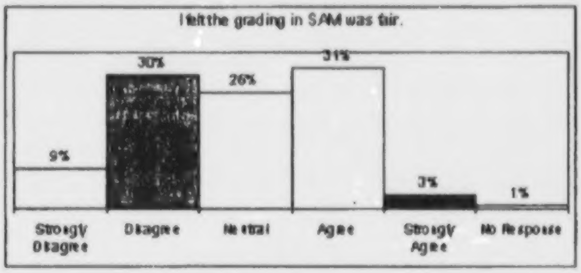


The overall consensus was that the students felt that Sam 2000 was a reasonable assessment tool and adequately tested the skills that were taught in the course.

Students were also surveyed on their opinions of computer-based testing as a fair method of assessment. These questions evaluated students' perceptions on grading impartiality and impact on performance.

Grading impartiality. This question evaluated students' perception of the fairness of the automated grading system included in the software. As shown in Figure 5, 34% of the respondents felt that the grading in Sam 2000 was fair while 39% of them did not find the grading fair. The remaining students (26%) were neutral. As mentioned previously, SAM did not provide partial credit to incorrect responses; therefore, students would receive no credit if they included an extra space while inserting text despite performing the correct actions.

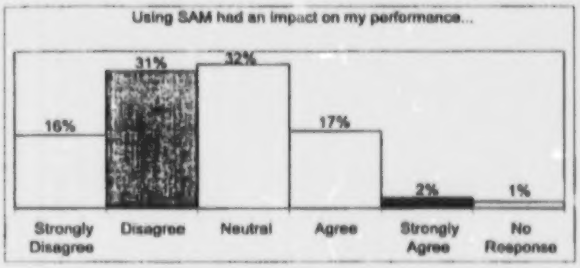
FIGURE 5
GRADING IMPARTIALITY



Another recurring criticism from students was that SAM did not provide capabilities for students to review their specific responses to each question to see why they were graded incorrectly (i.e., students could not view each keystroke they performed.)

Impact on performance. Students evaluated the effect of using a CBA tool on their exam performance. As shown in Figure 6, only 19% of the students felt that using Sam 2000 negatively impacted their performance on the exam. The remaining students felt neutral or disagreed with the fact that using SAM impacted their performance.

FIGURE 6
IMPACT ON PERFORMANCE

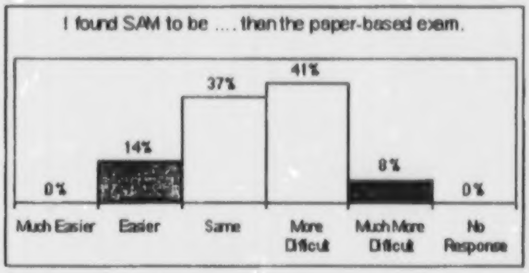


Students were being evaluated in the same environment in which the skills were learned. Although most students have never been tested on a computer prior to the course, the majority of the students were comfortable being evaluated in this environment.

The next group of questions asked students to compare computer-based assessment to conventional examinations and to provide their preference for a particular exam medium.

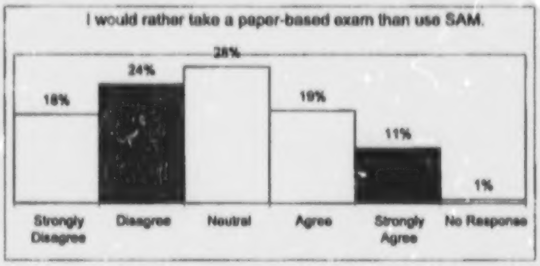
Comparison to paper-based test. Students compared the difficulty of the CBA (Sam 2000) with the paper-based assessment. Figure 7 demonstrates that 37% found that the two tests were comparable, neither easier nor more difficult. Only 14% found that the SAM test was easier and the remaining 49% found it more difficult or much more difficult. Two points should be noted. First, the Sam 2000 test was administered prior to the paper-based test, thus the students may have done better on the paper-based test because they benefited from the experience with the Sam 2000 test. Second, the Sam 2000 test did not award any partial credit.

FIGURE 7
COMPARISON TO PAPER-BASED TEST



Exam preference. This question evaluated the students' preference for a particular exam medium. Students were able to rate their preference for either a paper-based exam or a computer-based exam. As shown in Figure 8, 28% of the students felt neutral, neither preferring the SAM exam nor the paper-based exam. Of students who showed a preference, 58% (42% of the total respondents) preferred the Sam 2000 exam and 42% (30% of the total respondents) preferred taking a paper-based exam.

FIGURE 8
EXAM PREFERENCE

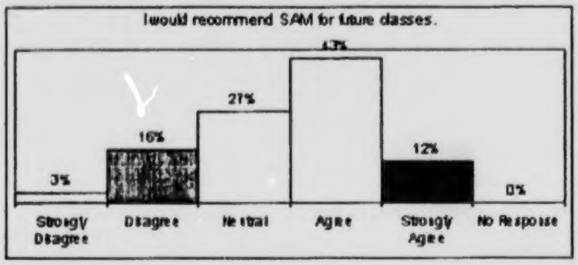


The responses to this question are interesting because on average the students scored higher on the paper-based exam then on the computer-based exam. Although the majority of the students scored higher on the paper-based test and felt that it was easier, as reported in the previous question, the students were favorable toward the CBA because of the novelty of the testing environment. Other positive comments about the software included the organizational feature of the testing format (i.e., at any point during the exam, students were able to view exactly which questions were completed) and the independence amongst questions (i.e., an incorrect response to a particular question did not affect the response to another question.) Most of the students agree with the sentiment—"in a computer class, tests should be administered on a computer."

Finally students were asked whether or not to consider computer-based assessment in the future.

Future use. Based on the students' experiences in the course, students provided their recommendations on using Sam 2000 in future computer classes. Figure 9 reveals that while 55% of the students would recommend the continued use of the testing medium, 27% of the students felt neutral about the decision and only 19% would not recommend using it in the future.

FIGURE 9
FUTURE USE



Student Examination Performance

Two approaches were taken in order to gather data concerning student performance. Both tests were scored on a one-hundred point scale. The average score on the SAM exam was 84.8%, while the average score on the traditional paper-based test was 93.1%. The grade distribution is shown in Figure 10.

FIGURE 10
COMPARISON OF TEST SCORES

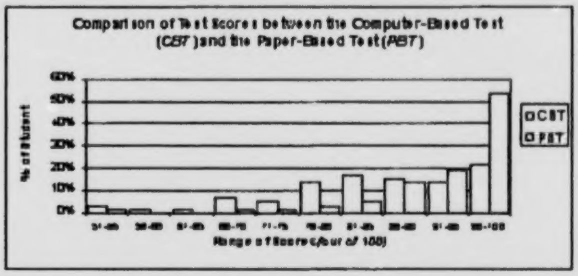
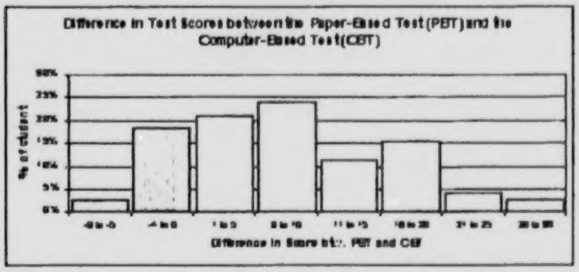


Figure 11 shows the difference in student's performance between the computer-based test and the paper-based test. Twenty-one percent of the students did the same or better on the SAM exam while the remaining students did better on the paper-based exam. Forty-five percent of the students scored higher on the paper-based test by one to ten points. The remaining 34% improved their scores by more than ten points.

The improved paper-based test score can be attributed to the fact that the paper-based test was administered after the SAM test. Students were administered that SAM test during one class period. At the end of the exam period, students were able to review their results. During the next class meeting, the students were administered the paper-based test.

FIGURE 11
DIFFERENCE IN TEST SCORES



Another reason why the scores are higher on the paper-based test was that the instructor was able to provide partial credit. As mentioned previously, no partial credit was awarded on SAM.

Faculty Perceptions

From the perspective of the course instructors (both full-time faculty and adjuncts), there is a general consensus that SAM is a success. Instructors found that the benefits of using SAM include less time writing exams, reduced grading time, simplified record keeping of grades through the reporting features, and improved test validity through post-test statistical analysis.

Despite the overwhelming benefits of using SAM, there are drawbacks. SAM has a limited test bank; although multiple tests are available, questions are often re-used by instructors from semester to semester. Furthermore, instructors cannot add or edit test questions to the test bank. The test-bank contains some poorly worded questions. There are no constructed response questions included on the exam; each question tests a single skill and not a series of steps. The most notable drawback of SAM is that instructors cannot see every keystroke a student performs. This is problematic when a student is marked wrong on a problem and he/she insists that they did the problem correctly. There is no way available to review the steps they performed.

Comparing the CBA to the paper-based exam shows that there are benefits and drawbacks with each. Instructors agree that the most significant benefit of using SAM is the ability to evaluate students' mastery of specific skills that can only be assessed by recording interim keystrokes. For example, if an instructor wants to test a student's mastery of the "Copy and Paste" commands, there is no feasible way to evaluate this through a paper-based exam where the instructor sees only a final product. Without watching a student use the copy and paste functions, there is no way to determine if the student simply retyped the text, rather than pasted it, as directed, in a specified location.

On the other hand, SAM test does not produce a final product, just a series of skills. In the "real-world", employees are evaluated on their final product, not interim keystrokes.

CONCLUSION

This study of using a CBA's for assessment was based on student experiences evaluated with questionnaires and informal interviews, reactions of instructors (both full-time faculty members and adjuncts), and a comparison of Sam 2000 to the traditional testing format as described above in terms of measuring student abilities.

Results from the 133 student questionnaires and various informal interviews were used to evaluate students' attitudes and perceptions toward computer-based assessment. Students evaluated ease of use, fairness of grading, perceived impartiality, perceived difficulty, perceived level of performance. Results showed that students demonstrated an acceptance of the CBA and even a recommendation for future use.

As technology is becoming the norm for delivery of courses, computer based assessment will become the norm for delivery of testing. This study investigated the use of skills-based tools in the assessment process and provided an overview of the techniques, the advantages and disadvantages, and an evaluation of the perceptions of students and faculty who use them.

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TELEMATIC EDUCATION IN INFORMATICS: A CASE STUDY OF THE PITFALLS AND THE CHALLENGES

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ABSTRACT

The authors share their personal experiences and try to give the reader a better understanding of what is involved in the application of telematic education and discuss the most important pitfalls and management issues regarding telematic education. An interpretive research approach was followed whereby the feedback of students was evaluated regarding their positive and negative experiences in a specific telematic education environment.

INTRODUCTION AND BACKGROUND

Telematic education could be regarded as one of the most challenging fields for tertiary institutions today. Although the technology allows us to basically do what we like in terms of giving the student service and support via the Internet, many questions stay unanswered in terms of what is good practice and what is bad practice. The authors of this paper share their personal experiences and try to give the reader a better understanding of what is involved in the application of telematic education and discuss the most important pitfalls and management issues regarding telematic education. The authors assume that the readers are familiar with all the concepts and definitions of telematic education and do not address it, except for giving the following citations:

> Telematic education (tele-: over a distance; -matic: by means of) refers to the way in which effective and efficient flexible teaching/learning environments have been created for you. Modern communication and information technologies (telematics) are skillfully combined into flexible educational delivery systems.

The Rector of the University of Pretoria, Prof. Johan van Zyl initiated the development of a formal Technology Plan for the University, when he took office in 1997. The aim of the plan is to enhance the University's competitive position by ensuring that technology is used in the best possible way to support its service delivery mechanisms. Based on this plan a telematic project team started searching for a web-based software package that would satisfy the needs of all the academic departments at the university of Pretoria in the same year. The Department of Telematic Education was later established and today serves as a supporting department to assist academic departments in establishing their own Web-based telematic environments for their different modules using the web-based package.

Unofficially the Department of informatics at the University of Pretoria had already been involved in telematic education since the introduction of their own website in 1995. Apart from using their web-site as an information source or marketing tool for everyone to see what they are offering, web-site pages were created for all the under graduate and post graduate courses (modules). These pages can only be accessed with a password and are mainly used as a resource for course material and general announcements.

The Department of Informatics established their first official telematic web-site for a first year course in 1999 with the support of the Telematics Department. The initial strategy was to migrate all part time modules to telematic module offerings, starting with the first-year level modules. This case study is based on experience and feedback from under graduate students (first year part time) as well as postgraduate students (MBA part time and modular[1]).

RESEARCH APPROACH

An interpretive research approach was followed to gather information about how students experience the telematic education environment. Apart from having several personal discussions with students, we also put a request on the bulletin boards (using the web-based package) of both the under graduate and post graduate modules to mention three positive and three negative aspects of the personal experiences they had with the telematic approach of education. The larger amount of responses came from the postgraduate web-site. The reason for that might be the fact that post graduate students were all MBA students and were mainly "off" campus and therefore were more involved in experiencing telematic education. Stated differently, they were more dependent on the web-site in terms of service and support.

THE TELEMATIC EDUCATION SOFTWARE PACKAGE

The University of Pretoria uses a web-based package for telematic education, which offers a large variety of facilities to both the student and the lecturer. The following is a brief summary of the most important facilities offered by the package.

- Students can register online and pay online.

- Students can access all course material for a specific module.

- Students can communicate via the bulletin board (discussion board) to lecturers and colleagues and discuss any module related issues with them. The discussion board also allows the users the attach files to messages like in the case of normal e-mail. This could be done on a public or private basis.

- All marks deserved by students for a specific model can be entered online and are immediately available for students to access.

In order for lecturers to use the package effectively, extensive training is needed. Although lecturers can be trained to act only as users and not as designers, it is strongly recommended that they should be trained as designers. This will put them in a position to manage their own courses (modules) completely and cut out many frustrations of dependency on other people.

THE NATURE OF TELEMATIC EDUCATION IN THE DEPARTMENT OF INFORMATICS

The first and maybe one of the most important starting points to ensure success in telematic education, is to establish sound relationships between the lecturers and the students. According to Leonard (1998) relationships of such a nature is complex and intrigue. Elements that play a very important role in this regard are: trust, commitment, co-operation, knowledge, technology and support. The process of establishing and maintaining sound relationships between students and lecturers in a telematic education environment should therefore be managed properly, keeping in mind the importance of these elements. This is sanctioned by Meyer (2000) who states that Telematic Education emphasizes the use of technology that will enhance the teaching and learning environment and if managed properly, Telematic Education has the ability to address the learning needs of all learners concerned.

In general one can say that telematically delivered programmes are based on the innovative integration of:

- contact tuition;

- paper-based distance education;

- electronic education through technology-driven learning packages that use:
  - interactive multimedia;
  - virtual campus technology that integrates with other technologies, such as the Internet;
  - and interactive television teaching and video conferencing.

In the case of the Department of Informatics the web-based part is mainly used for providing study material to students, giving them access to their marks and to communicate via the discussion board. Contact sessions were minimized to two or three per semester.

One of the immediate assumptions or expectations on the users' (lecturers') side was that this approach towards training could only make life easier. In our case we thought that this approach would ensure less work because our part time classes were "replaced" by the telematic approach. We soon realized that this is not really the case. From the students' viewpoint it is fair to say that they new that the part time classes were falling away, but they expected an even better "service" than in the past when contact sessions of at least once a week were available.

To overcome the problems that were created by certain "false" expectations on both the lecturers side and the student side, and the fact that one of the under graduate Informatics modules were of a practical nature (programming in Natural) a lot of planning was necessary. The following is a summary of the most important obstacles and how we tried to overcome them:

- Telematic students want "better" service and support levels because they feel "neglected." In order to achieve this, we decided to allocate a specific lecturer to a telematic module. This lecturer has the responsibility of watching the bulletin board every day and to react to all messages. The lecturer is also responsible for uploading all relevant study material onto the "notes page."

- In order to ensure that communications between students and the department stays on a sound basis, the above-mentioned lecturer has the primary responsibility of receiving and sending information to the students on a daily basis.

- Because of the easiness of communication (e-mail and the discussion board) we sometimes experienced an explosion of messages. These messages also came from some full time students who discovered the website. In order to overcome this problem we decided to "block" the full time students from getting access to the telematic web-based package. This was seen as a temporary solution to the problem. We soon learnt that students want a quick response to their messages (e-mail or bulletin board) and are ready to complain at higher levels if they don't get feedback soon enough. This forced us to communicate with students on a daily basis.

- Messages of an encouraging nature are placed on the discussion board as often as twice a week to give the students the feeling that the department "looks after them."

- Although the amount of contact sessions were much less than in the past, these contact sessions are arranged to co-inside with academic activities like tests. In other words we tried to arrange them in such a way that they could be used in an optimal way—not only for revisiting the academic work but also to write a test on previous work. Furthermore, the students get the opportunity to portray their experiences and feelings regarding the telematic approach.

- Slides of the lectures need to be more explanatory because telematic students don't have the opportunity to listen to the "life" lecture.

- We overcame the problems we experienced with the practical module by allowing students to do their practical work at home/word and to submit their answers via the web-site. We also introduced a practical contact session once per week for those students who really need more personal support with the programming.

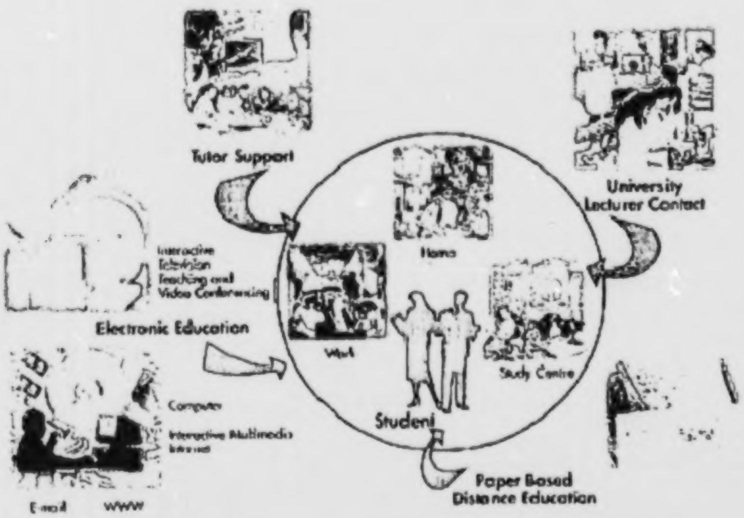
The service and support components that we argue are necessary for a successful Telematic Education environment is displayed in Figure 1.

How Do the Students Feel About the Telematic Approach?

In general the feedback we received was very positive. The overall feeling of students about the telematic approach could be summarized in the words of three students' feedback:

> "Wonderful product!!"
> "...Awesome!!"
> "... an absolute great system and I am sure continual use of it will prove to be very successful"

FIGURE 1
THE SERVICE AND SUPPORT COMPONENTS OF TELEMATIC EDUCATION IN THE INFORMATICS DEPARTMENT (UP)


Tutor Support
University Lecturer Contact
Home
Interactive Television Teaching and Video Conferencing
Electronic Education
Work
Study Centre
Student
Computer
Interactive Multimedia Internet
E-mail
WWW
Paper Based Distance Education
Mai
Lecturer communication/support via e-mail and bulletin

In the rest of this section some of the most important feedback received from students are analyzed briefly.

Student 1:

Positive points

1. Comprehensive; i.e., it contains all the details necessary to need and to know about each subject.
2. The posting of articles and grades.
3. A continuous link between the lecturer and students.

Negative points

1. It is a lengthy process to get your way around the system; i.e., from one subject to another and in a specific subject.
2. I am struggling for a week now to get continuous access (day and night) to the virtual campus.
3. There are some headings in each subject that could have been combined into one i.e., discussions, webct mail & webct chat.

   Isn't that part if the same thing viz. electronic communication.

Student 2:

Positive

1. Faster feedback on assignments/tests.
2. Detail on syllabus and calender, makes it easier to plan. (Although the IT calender is 2 days out for some students.)
3. Vehicle to post addisional material & info without making copies—distribution of large volumes of electronic info.

Negative

1. Some lectures do not use WebCT. After 3 months there's not one message on some of the subject discussion groups.
2. WebCT e-mail not in use. Everyone uses their own private e-mail. Not even the Director used the WebCT e-mail for his last message to MBA students.
3. Time delays in responses from lecturers, to questions posted to WebCT.

Student 3:

Positive

1. Can access all relevant information from anywhere at any time.
2. When I have misplaced my study guide, I can always have a look on WebCT.
3. Improve the information exchange between lecturers and students (it is often impossible to get hold of lecturers personally or telephonically).

Negative

1. Uncertainty in the beginning about the features (the introductory session helped).
2. I have not been able to get hold of the ITM Notes (I do not know if I am following the wrong links or if they have not been posted yet).
3. Having to type in my password 3x to get to the discussion board, is a nuisance.

Student 4:

Positive

1. Quick flow of information, the discussions and the update.
2. A more open platform than individual e-mails.
3. Overall scope-academic and non academic information.

Negative

1. Facilities set to support WebCT disorganized e.g., who is in charge at the lab reserved for this purpose. No idea who should provide password to use the computers.
2. It is not always easy to download the attachments depending on whether, for example it is in PowerPoint, Access, Excel etc.

Student 5:

Positive

1. Having marks available 24 hours a day.
2. Quick interaction with and response of lecturers.
3. Easy reference to study-guide, assesment, mark allocations, etc.
4. Ability to download reference articles straight from WebCT.

Negative

1. My personal server is not always operational.
2. Having to re-enter id and password twice.

Brief Analysis of Student Feedback

Out of the above student feedback (which were quoted precisely as the students sent it via e-mail) it is clear that they enjoy the facility of having online access to all the components and facilities offered for a specific course. The feedback also emphasizes the fact that they appreciate contact with lecturers on a regular basis. Furthermore the easy electronic download of study material saves time and money for them.

The most important warnings given by students for the success and acceptance of this approach is proper training of the users (students and lecturers) and the effective management of the web-based package by lecturers. They expect from lecturers to communicate with them every day and to upload all the important study material onto the "notes page" on a regular basis. In other words, it is and will only be a pleasure for them if the web-based approach gives them better service and support than normal class contact. This on the other hand asks even more energy from the lecturer! They expect from lecturers to practice what they preach in the sense that they want lecturers also to understand and use the package on a regular basis. Last but not least, the most important element that impact negatively on the telematic approach is the availability of the technology. If the system is down or if the response time is slow or if the general technical support from the university's side is unsatisfactory, students tend to get negative towards this approach.

CONCLUSION

In their search for a (proper) university education, students enroll with certain expectations from the university, departments and staff members. These expectations can be summed up as gaining knowledge that is relevant to their working environment and personal enrichment, and receiving the necessary service and support from lecturers. This paper concentrates on the changing approach and attitude towards education and learning because of the employment of new technology. Telematic education has brought many challenges for both student and lecturer.

Lecturers should always be aware of the expectations of their students. At the same time lecturers should communicate their expectations to students. Because of the limited opportunities for personal contact, serious relationships should be built between students and lecturers. These relationships should be built on and enforce mutual cooperation trust, commitment, co-operation, knowledge and support. Both parties should be aware of the necessity to change their respective attitudes and approaches towards the learning activity, in order to adapt to the changing environment of education.

Telematic students have the same basic needs and rights as full-time students, e.g. motivation, encouragement, certainty, and access to relevant information (the right to be informed). However, lecturers often assume that these needs change immediately to self-motivation, self-generated learning, etc. when new technology is employed. With the implementation of technology certain changes has to be made so that students still 'feel' that their basic needs are looked after. Therefore this paper proposes continuous communication with students in order to understand students' needs, and providing timely information. In a support capacity the lecturer should think of ways to complement (supplement) the lack of contact.

The telematic experience in itself is a learning process. Students should gradually (systematically) become aware of the larger responsibility that they have towards themselves. They should eventually manage their own studies, where the lecturer gives less and less support. However, this is a timeous process. Students should always feel that they get the support needed.

ENDNOTE

1. Students that attend classes in a two-week block session once or twice a semester.

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PREDICTING PHYSICIANS' INTENTIONS TO ADOPT INTERNET-BASED HEALTH APPLICATIONS: A FIELD STUDY UTILIZING THE EXTENDED TECHNOLOGY ACCEPTANCE MODEL

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Extended Abstract

Information technology (IT) has become pervasive in the healthcare industry. Many may view the Internet as a strategic healthcare tool. It has been suggested that Internet-based health applications (IHA), for example, electronic medical records, electronic billing, patient scheduling, patient monitoring, remote consultations, email, etc., can enable the health care industry to reduce its inefficiencies and errors in the care delivery processes (HIMSS/IBM Leadership Survey, 2000). While the use of IT in healthcare has increase tremendously, physicians still have not fully embraced the valuable resource of the Internet.

We exist in an age where information technology (IT), information systems (IS), the Internet, electronic commerce (E-commerce), e-business, telemedicine and even e-health are academically recognized, industry promoted, and governmentally sponsored. Within the United States, our daily lives have become increasingly computerized and electronically connected. Information systems and information technology are prevalent in every sector of our society, including healthcare. The healthcare industry envisions information technology, particularly the Internet playing a pivotal role in the future delivery of e-health. Coile, (1999) cites the following benefits of an Internet-enabled medical practice.

- Electronic medical records available on a 24-hour basis;
- Continuous clinical data, e.g., hospitalized patients;
- Disease management programs;
- Patient monitoring, e.g., chronically ill, home care;
- Physician communication with patient via email;
- Collegial consultations without geographical boundaries; and
- Internet-enabled consumer eligibility, claims processing and electronic payment.

However, before such benefits can be realized, the adoption of IHA by key players, particularly physicians must occur. Despite the purported advantages of IT investments in healthcare many physicians do not widely use Internet-based health applications in their clinical practices. Physicians often misunderstand the functions and full potential of the Internet (Wang & Song, 1997). A 1998 survey by Healthcare Financial Management reported that forty percent of the physicians polled stated that they would probably not use computers or networks for clinical purposes even if training were provided and services were made available free or at a very low cost (Fotsch, 1998, p. 27). Health & Health Care 2010 report that less than 5% of physicians use computers to record all clinical information for an average patient. Clearly the recent events concerning terrorist activities in the United States have highlighted the already growing tensions between the perceived benefits of medical information technology (e.g., storage of patients' records such as DNA for identification purposes) and our civil liberties. The perceived threat to personal privacy and other leading barriers to the adoption of IHA persist (e.g., security/confidentiality concerns; unwillingness to share personal/medical information; unwillingness to use a credit card on-line; cost of computers and on-line access, computer literacy, lack of universal Internet access, etc.).

Grounded in the extended Technology Acceptance Model (TAM2) theory (Venkatesh & Davis, 2000), this research presents the findings of a field study, which examined Hawaii based pediatricians' intention to adopt Internet-based health applications. This paper is a healthcare + Information theory research project in progress.

AN EXPLORATORY STUDY OF THE STRUCTURE AND ACTIVITIES OF MIS ADVISORY BOARDS

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ABSTRACT

MIS Advisory Boards can be a valuable asset in achieving the goals of a university's MIS program. A search of the literature reveals much indirect evidence of the positive role that advisory boards can play in promoting the interests of MIS programs. In this preliminary investigation, we surveyed undergraduate MIS Advisory Boards concerning their structure and activity sets. We found that for many MIS programs, advisory boards are an untapped and underutilized resource.

INTRODUCTION

In 1990, the MIS program area at Indiana State University, in conjunction with our Decision Sciences program area, formed an advisory board. The purpose of the advisory board was to provide a vehicle for improving the quality of our program areas and to strengthen communication channels between our programs and the companies who hire our graduates. The advisory board was formed to service our undergraduates.

The purpose of this research is to explore the nature and scope of MIS advisory boards across North America. We examined the basic structures and the activities of MIS advisory boards. This exploratory study lays the groundwork for future studies designed to determine best practices and standards which are associated with successful undergraduate MIS advisory boards, and suggests that most MIS programs are not utilizing this potentially valuable asset.

REVIEW OF LITERATURE

A review of the literature on MIS advisory boards and learning was performed to determine what is formally known about the relationship between these boards and MIS programs. The search revealed little direct knowledge of advisory boards, but the literature hints strongly at the potential and utility of those boards.

At the most obvious level, companies can provide valuable insight into the knowledge and skills needed by employees and the currency of the MIS program. There is a long history of surveys of employers to glean these insights (Doke and Williams, 1999; Womble, 1994). Formation of MIS advisory boards can lend depth to these insights.

Money (1994) has proposed that universities should explore new channels of product delivery off-site courses, e-education, etc. Money also calls for broadening students' educational experience and speaks of the "content-based dangers of IS curriculum because of limited linkages between Universities and practitioners' worlds (p. 50), citing the work of Spruell and Franz (1993). Argyris (1990) theorizes that support for the educational experience of the student is needed beyond the classroom and program of course work. Each of these papers supports the broadening of educational experience through cooperative experiences, internships, field trips, guest speakers, etc. We see MIS advisory boards as playing an important role in facilitating each of these activities.

Cale (1994) provides an example of a very intense broadening and deepening linkage between the University and practitioner world through student work with a mentor company an activity that can be facilitated through an MIS advisory board. Fry (1993) also makes a case for tight linkage between education and industry. This work describes successes from a cooperative curriculum development program partnering academics and industry representatives. Jacobs (1995) discusses the role of an Advisory Board and how it can tighten linkages between academics and university including the providing of speakers to students.

It is difficult to underestimate the potential of mutually beneficial partnerships between Universities and industry. Lazer and Norcio (2000) extol the virtues of these partnerships for research and for training. We see advisory boards as an important first step in the development of these partnerships.

Pierce and Henry (1994) found a difference between how educators and IS professionals perceive ethical issues, practices, abuse opportunities, extent of abuse, etc. One example of these differences is that professionals see ethical issues arising more frequently than do academics (i.e., more of a real world problem). Because of these differences, educators may not be teaching ethics as knowledgeably as it could be taught. The authors conclude that, since teaching ethics is not easy (especially given that academics and IS practitioners have different perceptions), it is important that educators and professionals form a partnership. They further conclude that it is important to instill ethical standards in IS students. MIS advisory boards provide an opportunity to foster this partnership.

Dick, et al. (1995) suggest colloquium evenings and short seminars as appropriate vehicles to deliver an understanding of professional ethical expectations, the role of IS professionals, negotiation skills, and where an IS career might lead. Benbasat et al. (1980) have noted that too much emphasis has traditionally been placed on developing students' technical skills and not enough on behavioral or organization skills. The aforementioned colloquia and short seminars are one means of increasing behavioral and organizational skills. MIS advisory boards can serve as a platform for reinforcing students' understanding of these critical skills.

One informal method of workplace learning is dialogic learning learning through informal discussions with other workers. Gardiner and Singh (91) have found that cooperative education programs in Science and IS result in students whose transition to the workplace is less difficult than their (non-coop) peers. Cooperative education is a strategy of applied learning which is structural, developed, and supervised by a university in collaboration with one or more employing organizations. The philosophy underlying cooperative education is closely aligned with the experiential learning strategy (Galliers, 1987; Lee 1987; Little and Magetson, 1989; and Wersky, 1989). Small, et al. (1998) have found that cooperatives can provide another avenue for students to engage in experiential learning, including through community service projects. As with previously mentioned activities, MIS advisory boards can augment cooperative efforts.

Romm and Wong (1997) have found that the best method to teach soft skills is through case study. Cragg (1998) found that site visits serve as a form of live case study for IS courses. The site visit brings reality to the students and provides variety in the learning experience while encouraging action learning. Further, the author contends that a site visit allows for a rich opportunity for students to explore theory and practice, expose students with little experience to the complexities of organizations, and help educators to keep up to date with current practices and problems. MIS advisory boards can play a useful role in facilitating site visits.

Recently Duncan (2000) provides perhaps the most direct evidence of the value of advisory boards. Duncan describes nine different methods for forming partnerships between universities and industry. She argues that advisory committees, composed of alumni, MIS managers, and recruiters, are an excellent means of determining which hardware, software, and applications should be adopted by the university. Duncan argues that the advisory committee is in a good position to provide input regarding the relevancy of the content of individual courses and the curriculum as a whole. She advocates that the committee meet as a body at least once a year, with an agenda including a report on hardware and software in use by the university, curriculum changes being considered, and any problems since the last meeting of the committee. She notes that faculty requests for resources and curriculum changes that have been supported by an advisory committee are usually looked upon more favorably by the campus administration. She further notes, based on personal experience, that advisory committee members are more likely to enter into other form of "partnership with the university.

Summary of the Literature

We found a substantial body of literature indicating that MIS advisory boards can facilitate a broad set of pedagogically valuable activities. Activities such as seminars, colloquia, speaker visits, visits to industry sites, and promotion of professional ethical standards enrich and broaden the student learning experience. In addition, advisory boards strengthen ties between universities and industry, and provide valuable input on hardware, software, and the curriculum. This study attempts to determine the scope and frequency of some of these activities in today's MIS advisory boards.

METHOD

This study was carried out in phases. First, the literature on advisory boards and MIS programs was reviewed to determine what is formally known about the relationship between advisory boards and student learning. Second, a search of the Internet was conducted in an attempt to find a representative sample of convenience of MIS advisory boards (Appendix A). Thirty-nine organizations were identified and included in the study.

In the third phase of the study, representatives from these advisory boards were contacted via email and asked to respond to a one-page survey (Appendix B). We sent out three waves of e-mails at approximately 10-day intervals. We received responses from only thirteen of the organizations, or 33 percent.

Surprised by the response to our targeted list of 39 schools, we decided to supplement the initial survey. We sent surveys to a new set of schools drawn from a set of participants at the 2000 Conference of Information Resources Management Association. We sent surveys to thirteen of these schools and received a response from four, or 31 percent.

RESULTS

We are disappointed in the low response rate to our surveys. If we were disappointed with the low response rate, we were astonished that our Internet search proved to be so unreliable in locating respondents who actually had the kind of undergraduate MIS advisory board we are interested in. We found many other kinds of advisory boards, most of which fell in these four categories.

1. IT advisory board for University serving as a board of directors to formulate policy for the university's IT department (as opposed to the MIS program).
2. IT advisory board for Schools of Business serving in the same capacity at number one above.
3. An advisory board for Schools of Business serving as curriculum, etc., advisors for the entire School of Business.
4. An MIS advisory board serving in an advisory capacity for the graduate MIS program.

Of the thirteen respondents, only five have MIS advisory boards serving the undergraduate program. Although it is somewhat presumptuous to attempt to characterize undergraduate MIS advisory boards base on only five responses, we summarize the results so far in Table 1.

Based on the limited responses above, it is apparent that advisory boards are providing basic services, but are not being fully utilized for financial support.

In addition to the above results, the five respondents have an average of 17.4 members sitting on the advisory board, and the boards meet an average of 2.1 times per year. For two of the schools, we found that members run the gamut from CIO to entry-level positions. For the other three schools, members were CIOs and other high-ranking executives. At Indiana State University, not included in the survey, the question of who serves on the advisory board is a dilemma. High-level executives are in a better position to fund requests for resources. Lower

TABLE 1
SURVEY RESPONSE DATA

Question	Number of "yes" responses	Percent of "yes" responses
Do you allow more than one advisory board member from the same company?	4	80
Do the majority of the companies regularly hire your MIS graduates?	4	80
Do the advisory board members provide money for awards and scholarships to MIS students?	3	60
Do the advisory board members regularly provide feedback on the MIS curriculum on at least an annual basis?	5	100
Are internships offered by the majority of the MIS advisory board companies?	3	60

level members tend to exercise direct control over the hiring of our graduates. This study shed no light on resolving the dilemma.

Of the eight respondents who currently did not have an advisory board, two (25 percent) indicated that planning for an advisory board for the near future was in place. Although we can draw no firm conclusions based on such slender response, we can state that there is significant interest in establishing advisory boards.

We received four responses to the second set of questionnaires. None of these four respondents had an MIS Advisory Board. This result suggests that there are many schools which are not taking advantage of the potential that an advisory board provides.

IMPLICATIONS

This research provides evidence that advisory boards are very much an unexploited resource for MIS programs. Several of the respondents who do not currently have undergraduate MIS advisory boards have indicated that advisory boards are a good idea, and some have plans to initiate such boards in the near future. Our research indicates that advisory boards can play a large role in assisting MIS programs than what might at first be envisaged. Finally, nearly all our respondents indicate an interest in receiving the results of our study, evidence that this under-researched aspect of MIS education is of interest.

More research on advisory boards is needed. Our low response rate is evidence that MIS advisory boards are much more uncommon than we had believed. We need to confirm whether or not this apparent lack of MIS advisory boards is real. We remain convinced that advisory boards can be a valuable asset to an MIS program, and we hope to persuade MIS programs that the adoption of an advisory board can provide a real and tangible service to their students.

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APPENDIX A

1. http://www.slis.indiana.edu/Degrees/mis/misab.html - IU Bloomington School of (MIS program = master of information science). Chairperson = Rob Kling, kling@indiana.edu, (812) 855-9763, fax (812) 855-6166

2. http://www.sba.udayton.edu/mis/adv_board.htm U of Dayton MIS and Decision Sciences Dept, school of Business Administration Chair = Jeffrey Hoffer (professor and chair), hoffer@udayton.edu, (937) 229-2938

3. http://rlieb.ba.ttu.edu/misAdvBoard.html TX tech MIS Advisory board (under construction) http://www.ba.ttu.edu/rlieb/misadv.htm TX Tech U MIS Advisory Board Information Systems and Quantitative Sciences, School of Business Administration. Contact person = Robert Lieb, robert.lieb@ttu.edu

4. http://www.umsl.edu/divisions/business/mis/mentor/advisory_board.html U of MO at St. Louis http://www.umsl.edu/divisions/business/mis/board_visitors.html U of MO at St. Louis, Management Information System, College of Business Administration, Contact person = Dr. Douglas Durand, Dean, at Durand@umsl.edu, or Dr. Robert Nauss, AS Area Coordinator, at Robert_nauss@umsl.edu

5. tp://www.unex.ucla.edu/shortcourses/directory/it_advisory.htm - UCLA (IT Advisory Board) Computer Science Dept, School of Engineering and Applied Science IT Advisory Board member contact person = Dr. Alfonso F. Cardenas, cardenas@cs.ucla.edu, (310) 825-7550 Computer Science Dept Alumni Advisory Board chair = Dr. Don Calhoun, calhoun@standfordalumni.org, (310) 792-9089

6. tp://www.cs.panam.edu/chen/pubinfo/advisory/meetingF00.html- U of TX Pan Am (Computer Science Advisory Board). Department of Computer Science, Computer Science Advisory Board Chair = Ruben Galvan (no contact info), Computer Science Advisory Board Executive secretary, and Dept. of Computer Science Chair = Dr. Pearl Brazier, brazier@panam.edu, (956) 381-2320, 381-3455

7. tp://www.uic.edu/cba/crim/MinAgnda/BrdMnJun.htm - U of IL at Chicago (Center for Research in Information Management Advisory Board), College of Business. Contact persons = Bob Abrams, rabrams@uic.edu, (312) 996-2676, Herb Zuegel, hzuegel@uic.edu, (312) 996-2679

8. tp://www.slu.edu/colleges/business/dsmis/oscmboard.htm - St Louis U (advisory board of the OSCM concentration: Operation and Supply Chain Management) Department of Decision Sciences & MIS, School of Business & Administration Contact person = Kevin Forness, FornessK@slu.edu, or dsmis@slu.edu, (314) 977-3878

9. tp://cobweb.creighton.edu/mis/advisoryBoard.htm - Creighton U, IS Dept's advisory board, Department of Information Systems, college of Business Administration, Contact person = Dr. Michael Echols, Executive Director of Creighton Institute for Information Technology and Management, mechols@creighton.edu

10. p://www.bsbpa.umkc.edu/mismba.htm -U of MO at Kansas City Management of Information System, School of Business and Public Administration Contact persons:

    Nancy Day, Director of Business Administration 816-235-2333 (can't access e-mail addresses)

    Sidne Ward, Assistant Professor of Management Information Systems, wards@umkc.edu, 816-235-2321

    Roger Pick, Associate Professor of Management Information Systems, pick@acm.org, 816-235-2336

11. http://sbaeweb.fullerton.edu/msis/spring%20news.htm - Cal State Fullerton Management Science/Information Systems Department, School of Business Administration & Economics Contact person = Department Chair Barry Alan Pasternack, Bpasternack@fullerton.edu, (714) 278-2221

12. http://wbdc.hcob.wmich.edu/Advisory%20Board.htm - Haworth College of Business Advisory board steering committee contact person = Jan Andersen, President, janbeyond@earthlink.net

13. http://www.cob.fsu.edu/grad/mba/advisory.html - FL State U, MBA Advisory Board College of Business Contact person = Dr. Joey George, dept of information and management science at jgeorge@cob.fsu.edu, or Christopher Campbell, President of the MBA Advisory Board, at ccampbell@campbellgroup-i.com, College of Business's phone # (850) 644-6458

14. http://cba.ksu.edu/org/mis/club/sponsors/Friendbg.htm - Kansas State U Management Department, College of Business Administration, Contact persons = Dr. Roger McHaney, faculty advisor, mchaney@ksu.edu, (785) 532-7479 Or mis_club@ksu.edu

15. http://www2.uta.edu/infosys/ITAdvisoryCouncil/ - U of TX at Arlington, ISMS advisory board Department of Information Systems and Management Sciences, College of Business Administration Contact person = Dr. R. C. Baker, Dept Chairman, rcbaker@uta.edu, (817) 272-3547

16. http://www.haas.berkeley.edu/~citm/advisory.html - UC Berkeley, The Fisher Center for Management and Information Technology Hass School of Business Contact person = Dr. Arie Segev, segev@haas.berkeley.edu, (510) 642-4731 or citm@haas.berkeley.edu

17. http://www.outreach.washington.edu/extinfo/certprog/mri/mri_brd.asp - U of WA Electronic Information and Records Management (Certificate Program) Contact person = uweo@u.washington.edu (206) 543-2320, (800) 543-2320

18. http://depts.washington.edu/ebiz/program/board.html - U of WA E-Business Advisory Board, business school Contact person = Dr. William E. Burrows, foundation of e-business, burrows@u.washington.edu, (206) 543-4474, or Ebizinfo@u.washington.edu

19. http://www.pontikes.siu.edu/advboard.htm - Southern IL U at Carbondale (Pontikes Center for Management of Information's advisory board) College of Business and Administration Contact person = Dr. Gregory White, Director, jbahoric@cba.siu.edu, (618) 453-7791

20. http://www.sjsu.edu/senate/s82-10.htm - San Jose State U, Information Systems and Computing advisory board Information System dept. Contact person = IS Interim Director sksh@email.sjsu.edu, Special Projects dling@email.sjsu.edu, (408) 924-7305

21. http://www.terry.uga.edu/mis/Advisoryboard.htm - U of GA Dept of Management Information Systems, The Terry College of business Contact person = Dr. Patrick McKeown, head of the MIS dept, pmckeown@terry.uga.edu, (706) 542-3341

22. http://www2.uta.edu/infosys/ITAdvisoryCouncil/ U of TX @ Arlington Dept of IS and MS Contact Dr. R. C. Baker, dept. chair, at rcbaker@uta.edu

23. http://www.uark.edu/depts/cisqinfo/advisory.html U of AR Dept of Computer Info Sys and Quantitative Analysis Contact Dr. Fred Davis, dept chair, at fddavis@comp.uark.edu

24. http://www.csun.edu/acct/advcncl.html Cal State Northridge Dept of Accounting and MIS Contact Dr. Earl Weiss, dept chair, at earl.weiss@csun.edu or acctmis@csun.edu

25. http://www.bus.orst.edu/About_the_College/Information_Management.htm OR State U Dept of Accounting, Finance, and Information Management advisory council Contact Dr. Ilene Kleinsorge, faculty, at ilene@bus.orst.edu

26. http://cobe.boisestate.edu/govern/exec/notes.htm Boise State U College Of Business and Economy Advisory Council (Computer Information System) Contact Dr. Davis Groebner, dept chair, at dgroebne@boisestate.edu

27. http://www.bu.edu/ctf/people/ITboard.html Boston U Information Technology advisory board Contact Dr. Azer Bestavros, Computer Science dept chair, at best@bu.edu

28. http://www2.clarku.edu/newsite/gsom/connect/index.shtml#advisory Clark U, Worcester, MA, Grad School of Management advisory council Contact Dr. Edward Ottensmeyer, dean, at eottensmeyer@clarku.edu

29. http://www.csc.calpoly.edu/department/iac/bylaws.html Cal Poly Dept of Computer Science Contact Dr. Sigurd Meldal, dept chair, at smeldal@calpoly.edu

30. http://www.sas.muohio.edu/advisorycouncil/ - Miami U, OH School of Engineering and Applied Science advisory board Contact Dr. Marek Dollar, dean, at dollarm@muohio.edu

31. http://134.53.40.1/dms/duricydd/mis381/advisorycouncil.htm Miami U, OH Dept of Decision Science & MIS business advisory council Contact Dr. David Yen, dept chair, at yenbc@muohio.edu

32. http://grad.cgu.edu/~icouncil/Council/Council-Advisory.htm Claremont Graduate University School of Information Science, IS Student Council advisory board Contact Joe Vatanasombut, president of the student council (student), at vatanasb@cgu.edu

33. http://home.uleth.ca/man/board/board.shtml U of Lethbridge Faculty of Management advisory council. Contact Dr. Ali Dastmalchian, dean, at dastmal@uleth.ca

34. http://www.fredonia.edu/business/baaac/ - State U of NY @ Fredonia Dept of BA and Accounting advisory council Contact Patrick McNamara, advisory council secretary, at pmcnamara1986@kellogg.nwu.edu

35. http://www.som.umass.edu/som/dev/bac.html U of Mass @ Amherst Business advisory council Contact Dr. James Smith, chair of Dept of Accounting and Information System, at jfs@som.umass.edu

36. http://www.ecsu.ctstateu.edu/depts/edu/ - Eastern CT State U Center for Instructional Technology (CIT) meeting Computer Information System Advisory Council (CISAC)

38. Education Dept. http://www.ecsu.ctstateu.edu/depts/edu/ - Eastern CT State U Center for Instructional Technology (CIT) meeting Computer Information System Advisory Council (CISAC) Education Dept. Contact Dr. David Stoloff, education Dept. chair, at stoloffd@easternct.edu

39. http://www.tamu.edu/president/plan/Business.htm (this site mention the information system advisory board) - TX A&M University Center for the Management Information System Advisory Board (Home = http://cmis.tamu.edu/) Department of Information & Operations Management Contact Dr. George Fowler, Director, at gfowler@CGSB.tamu.edu

APPENDIX B
MIS ADVISORY BOARD SURVEY

Dear MIS Professional,

Like you, we are involved in MIS and academics. Approximately ten years ago we developed an Advisory Board consisting of members from industry to help guide our MIS major. We have asked this Board for advice regarding curriculum and also have asked for help for scholarships.

Now, we would like to learn more about what other schools are doing with advisory boards. An Internet based search leads us to believe your institution may also be doing something similar. We ask if you would provide us with a little information regarding your undertaking. We have structured a set of questions below and request that you please take a few minutes to answer them. A simple yes or no will answer most of the questions.

After we compile the questionnaires, we will send you a listing of schools participating and a summary of results. This information may help all of us working with advisory boards in the future. At a minimum, we will become aware of other institutions that we might possibly communicate with in the future to share ideas about benefits of advisory boards.

Please fill in your answer after each question and just use a simple reply to this e-mail.

1. Do you have an MIS undergraduate major?
2. a) Do you have a corporate MIS advisory board providing advices and/or resources for MIS major?
   b) If you answer no to the above, do you plan on implementing a corporate advisory board in the near future?

If you answer no to 2b), you have completed the survey. Thank you for your time.

3. About how many companies are represented on the advisory board?
4. Do you allow more than one advisory board member from the same company?
5. Do the majority of the companies regularly hire your MIS graduates?
6. How many times a year does the advisory board meet?
7. Do the advisory board members provide money for awards and scholarships to MIS students?
8. Do the advisory board members regularly provide feedback on the MIS curriculum on at least an annual basis?
9. Are internships offered by the majority of the MIS advisory board companies?
10. Provide a few small examples of the type of positions currently held by your advisory board members; for example, program analyst, project manager, Chief Information Officer.

ANALYZING THE FACTORS THAT AFFECT INTENTION TO ENTER A POST BACCALAUREATE BUSINESS EDUCATION PROGRAM

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ABSTRACT

Post baccalaureate business education programs are organized and administered in a variety of ways by colleges and universities throughout the United States. One principle that they have in common is that to be successful, there must be a well-integrated curriculum of education and business courses that focus and train the students to become the business educators of tomorrow. Prospective students make decisions to enter a post baccalaureate business education program based upon the curriculum requirements; however this is not the only factor that influences their decision.

There are many factors that influence a student's decision to enroll in and then subsequently complete a business education program. Some of these factors include: the location of the university, the entrance requirements of the university, the information satisfaction as perceived by the perspective student when they investigate a university program, the cost of the program and the number of credit hours required for completion. This paper studies the factors that affect a student's decision to enter a business education program.

REVIEW OF THE LITERATURE

Bronner (2000) found that the problems with business education programs as ranked by the presidents of State of Connecticut colleges and universities with business education programs include:

1. Lack of funding
2. Lack of adequate facilities
3. Lack of support from the school administration
4. Lack of positive attitude of counselors
5. Lack of time for professional development

Anderson and Sinha (2000) concluded that opportunities for business education teachers remain limited. Additionally, they found that the field is dominated by females and that satisfaction was a significant variable in choosing to enter the field.

These issues helped to explain the simultaneous decline in enrollment and growth in the number of business educators leaving the field. Of particular concern lately has been the aging teacher population and shortage of business educators. Okula (1999) found that as many as fifty percent of business teachers are nearing retirement age. She also noted that over the prior ten years, the number of college programs that prepare high school business teachers has dropped significantly. Equally important, Okula indicates that teacher certification requirements in some states make it very difficult for business professionals to enter the field.

LaBonty (1999) provides further evidence of the demand for business educators and the issues surrounding enrollment in the 1997-1998 NABTE survey. The findings indicate that the change in the number of enrollments in certification-only students dropped from 788 certification-only students in 1996 to 475 certification-only students in 1998, a decline of 40%. Additionally, the number of student teachers fell from 1,529 in 1991-1992 to 752 in 1997-1998.

The Connecticut Legislature created an 18 member Commission on the Teacher and School Administrator Shortage and Minority Recruitment (Lohman, 2000). The Commission reviewed what other states have done as well as what Connecticut accomplished in 1986 under the Education Enhancement Act which raised minimum starting salaries. Drawing from other states, the Commission considered raising starting salaries (even though Connecticut is reported to be the second highest in the USA), signing bonuses, loan forgiveness programs, assistance with real estate costs, incentives for veteran teachers, and incentives for retirees.

McEwen and King (1998) concluded that keyboarding continues to be the most frequently taught business subject. They also found that the student teaching experience played a significant role in the perception of the student's view of a business education program. Jennings (2001) examined national trends in keyboarding and found that although it is now taught early in the school system, it is considered to be an important skill. This finding was also supported by Womble, Adams and Stite-Gohdes (2000) who concluded that keyboarding and basic computing skills were an essential part of a successful business education program.

RESEARCH QUESTIONS

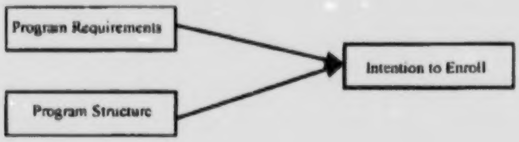
The research questions were developed as a direct result of observance of prospective students questions while they were inquiring about the business education program. The following research questions are the focal point of this investigation.

1. What program requirement factors affect a student's decision to enter a business education program?

2. What program structure factors affect a student's decision to enter a business education program?

The purpose of the research is to gain insight into the factors that the university should focus on in order to improve its ability to attract students into the business education program. Figure 1 represents the research model that served as the basis for this investigation.

FIGURE 1
INTENTION TO ENROLL IN BUSINESS EDUCATION RESEARCH MODEL



METHODOLOGY

A survey was completed of prospective students, who considered entering the post baccalaureate business education program at Central Connecticut State University, New Britain, CT. Questions were developed based upon factors that relate to the program of study as well as the university. The factors were drawn from observation by the business education chairman at Central Connecticut State University, and grounded in the literature from prior studies of factors that influence student's decision to enter a program.

The requirements for entrance into the post-baccalaureate business education certification program include an undergraduate degree in business or courses equivalent to the business core, a grade point average of at least 2.70, and passing the Praxis I (a standardized test for assessing reading, writing, and mathematical skills required by the State). Additional requirements include passing a keyboarding proficiency exam (42 words a minute after error penalties for 3 minutes with three or fewer errors, without correction) and passing a word processing exam or equivalent one-credit course. The required Business Education certification courses include two methods courses (one for skill and one for non-skill subjects), a software course, and an organization and administration course. Ultimately students must be admitted to the department (professional admission) and produce evidence of 500 hours of office experience within the past five years as well as write an essay and undergo a personal interview. Students must also meet the requirements from the School of Education and Professional Studies that include courses in foundations of education, principles and evaluation. It is estimated that most business graduates seeking business certification take approximately 39 semester hours of course work including student teaching.

Course scheduling permits full-time students to complete the requirements in a year plus a partial semester for student teaching. Part-time students generally take two and a half years. Connecticut requires a student to pass the Praxis II in business education for certification. A 30-hour master's degree in Business Education is available for certified business teachers. Individuals can count 12 credit hours from the certification program towards the master's degree requirements, but all coursework must be completed within six years.

The survey consisted of seventeen questions that utilized a five point Lickert scale. Two of the questions pertained to information satisfaction. The possible responses ranged from strongly disagree (5) to strongly agree (1). The factors that were tested are listed in Table 1.

The sample population was prospective students that inquired about the business education program at Central Connecticut State University. Central Connecticut State University is the only publicly supported university in the State of Connecticut that offers a post baccalaureate business education program. Each of the factors is classified as pertaining to either the program requirements or the program structure. Multivariate statistical techniques were utilized to analyze the results of the survey. Cronbach's Alpha was used to determine the reliability of the questions that comprise the factors that were tested. Inferential statistics consisted of Pearson's product moment test for correlation, and analysis of variance (ANOVA).

ADMINISTRATION OF THE SURVEY

The survey was sent to eighty-six prospective students who had requested information on the business education program at Central Connecticut State

TABLE 1
FACTORS THAT AFFECT STUDENT'S DECISION TO ENTER BUSINESS EDUCATION PROGRAMS

1	Enrolled in a different degree
2	Enrolled in another certification program
3	Enrolled in another university
4	Number of credits required
5	Cost
6	Poor job prospects
7	Low potential salary
8	Inconvenient class times
9	Student teaching requirement
10	Inadequate facilities
11	Keyboarding requirement
12	Distance
13	Entrance requirements
14	Masters degree requirement
15	Information satisfaction
16	Ease of use

University. A cover letter from the business education chair accompanied the survey requesting that the survey be completed and returned in an enclosed pre-addressed stamped envelope. The population consisted of one and a half year's worth of prospective students. These consisted of individuals that had contacted the university requesting program information between August 1998 and June 2000. Individuals that did not return the survey within a three-week time frame were sent a follow up request to return the survey. A total of forty surveys were returned. This represents a response rate of 46.5%. The very high response rate can be attributed to a sample population that was interested in the topic and was familiar with the requestor. The respondents communicated with him to gather information about the business education program, as he is the only advisor in the program at Central Connecticut State University.

There were no incomplete surveys; each of the forty surveys returned was usable. Twenty-five of the respondents were female, and fifteen were male. The returned surveys were encoded into the SPSS statistical package, with each question representing a construct.

The responses to each of the questions ranged from strong agree to strongly disagree. Table 2 presents a summary of the responses received.

ANALYSIS OF THE SURVEY

The three questions that pertain to enrollment in other programs were used to analyze the intention to enroll construct. The remaining questions pertain to either program requirements or program structure. Table 3 provides an identification of the program requirements/ structure grouping.

A Cronbach's Alpha test of reliability was performed for the constructs that comprise the program requirements and program structure. The Cronbach's Alpha for the program requirements was .724 and the Cronbach's Alpha for the program structure was .71; which was suffi-cient to conclude the internal reliability of the constructs. The constructs that comprised the decision to enroll exhibited a Cronbach's Alpha of .8379. A Cronbach's Alpha greater than .7 is generally accepted as exhibiting a strong internal reliability. A Pearson's product moment correlation test was performed for each of the variables as they affect the decision to enroll. An Alpha level of .05 was utilized. The results are presented in Table 4. Salary and cost exhibited a negative correlation (-.249 and -.013 respectively) and were dropped from further consideration.

TABLE 2
SUMMARY OF RESPONSES RECEIVED

	Strongly Agree	Agree	Not a Factor	Disagree	Strongly Disagree
I have enrolled in different degree program instead	15.0%	0.0%	45.0%	12.5%	27.5%
I have enrolled in another certification program	12.5%	0.0%	47.5%	10.0%	30.0%
I have enrolled in a business education certification program at another university	10.0%	0.0%	50.0%	10.0%	30.0%
The number of credits (time commitment) seemed too long	17.5%	40.0%	25.0%	10.0%	7.5%
The total dollar cost of courses seemed too much	12.5%	17.5%	50.0%	15.0%	5.0%
The job prospects were too unpredictable	12.5%	12.5%	40.0%	25.0%	10.0%
The salary of beginning teachers is too low	32.5%	15.0%	42.5%	7.5%	2.5%
Classes are offered at inconvenient times	2.5%	10.0%	50.0%	27.5%	10.0%
The student teaching requirement is a problem	22.5%	15.0%	40.0%	17.5%	5.0%
CCSU staff or facilities did not seem inviting	7.5%	2.5%	35.0%	27.5%	27.5%
The keyboarding requirement is unrealistic	25.0%	25.0%	25.0%	15.0%	10.0%
Travel distance to CCSU is too great	7.5%	7.5%	55.0%	10.0%	20.0%
My grade point average prevented me from meeting entrance requirements	0.0%	10.0%	40.0%	20.0%	30.0%
I was only interested in finding more information and am satisfied	7.5%	30.0%	30.0%	22.5%	10.0%
The requirement for a master's degree above certification is too much	7.5%	25.0%	32.5%	22.5%	12.5%
I did not get enough information to make a decision	2.5%	15.0%	32.5%	20.0%	30.0%
The entire process is too confusing	5.0%	32.5%	25.0%	15.0%	22.5%

TABLE 3
PROGRAM REQUIREMENTS AND STRUCTURE

1	Number of Credits Required	Requirements
2	Cost	Structure
3	Poor Job Prospects	Structure
4	Low Potential Salary	Structure
5	Inconvenient Class Times	Structure
6	Student Teaching Requirement	Requirements
7	Inadequate Facilities	Structure
8	Keyboarding Requirement	Requirements
9	Distance	Structure
10	Entrance Requirements	Requirements
11	Masters Degree Requirement	Requirements
12	Information Satisfaction	Structure
13	Ease of Use	Structure

TABLE 4
PEARSON'S PRODUCT MOMENT CORRELATION

Variable	Correlation Coefficient
Time Commitment	0.031
Cost	-0.013
Job Prospects	0.109
Salary	-0.249
Class Time	0.277
Student Teaching	0.101
Facilities	0.098
Keyboard Requirement	0.329
Travel Requirements	0.261
GPA	0.235
Information Satisfaction	0.143
Master's Degree Requirement	0.048
Ease of Use	0.097

Two hypotheses were tested to address the research questions.

H_1: The decision to enroll in a post baccalaureate business education program is positively affected by the program structure.

H_2: The decision to enroll in a post baccalaureate business education program is positively affected by the program requirements.

An ANOVA test was performed on the remaining variables that comprise program structure and program requirements at an Alpha level of .05. The calculated F value for the program requirements (3.21) and program structure (2.43) exceeded the F value, at six degrees of freedom. After we established that each of the null hypotheses failed to be rejected, a factor analysis was performed to determine the strength of the relationships of each of the variables that were tested.

DISCUSSION

The survey results demonstrated that there was a positive correlation between a student's intention to enroll and the program structure and program requirements. The program requirements provided stronger explanation of the intention to enroll. The factors that comprised the program requirements consisted of the student teacher requirement, keyboarding requirement, entrance requirements, master's degree requirement, and the number of program credits. Our research showed that the student teaching requirements and keyboarding requirement had the greatest affect of the program requirements, containing a correlation coefficient of .381 and .353 respectively. Although it was initially thought that entrance requirements would have a strong influence on a student's decision to enroll, the actual results yielded a very low correlation coefficient (.043). Our research showed that the areas that have the greatest impact on a student's decision to enroll consist of a combination of the program structure and program requirements variables.

One of the outcomes of this research has been a change in the admission process at Central Connecticut State University. Students are now required to complete keyboarding and word processing preliminary proficiency exams and the Praxis I exam prior to beginning course work in the School of Education.

Our survey was limited by the relatively small, homogeneous group. Each of the survey participants had prior experience with Central Connecticut State University. The prior experience could help to explain why cost was not considered as a factor. It would be generally recognized by the respondents that Central Connecticut State University is one of the lowest cost universities in Connecticut.

FUTURE WORK

An extension of this study will include an analysis of the effect of the structure of the curriculum of business education programs. This will include a comparison of the strength of the relationship between the business curriculum and the student's intention to enter a business education program, as well as the strength of the relationship between the education curriculum and the student's intention to enter a business education program. To perform this study, the survey will be extended to include detailed questions pertaining to each of the course requirements that are required for degree completion. Further study is planned to look at how the factors that influence enrollment into the program affect the program's outcome. Additionally, we intend to examine whether gender has a significant impact on the factors that affect the decision to enroll in a post baccalaureate business education program.

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ADOPTING DISTANCE EDUCATION— WHAT DO THE STUDENTS THINK?

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ABSTRACT

This paper reports the results of a study of student attitudes towards distance education in the US and in Australia. Students involved in the study included undergraduate and postgraduate students in the US and postgraduate students in Australia. The study used a model for distance education adoption as a basis for the research and the study was partly aimed at validating that model. The findings from the study indicate that for most people, particularly undergraduates, distance education is not the preferred option. There are however certain students for whom it is most attractive and to some extent it seems that these students disagree with the majority who see it as falling short of the traditional classroom experience. The study has the limitation of self-selection— further work in different disciplines and cultures would be worthwhile.

INTRODUCTION

Distance education, particularly "on-line" distance education is attracting considerable attention from both providers of education and potential students. A paper (Dick, 2000) published at IAIM last year noted significant similarities between this form of education and telecommuting—from the employer (or provider) perspective, there is the attraction of a wider pool of potential recruits (read potential students) savings on facilities and organisational infrastructure, meeting demand and changing work practices. From a student perspective, the telecommuting advantages of reduced travel, flexibility and the time to devote to other commitments (work, family etc.) are at least initially attractive. The IAIM 2000 paper proposed a model for evaluation of the potential adoption of on-line distance education. The development of this model is summarised in the "Background" section below and the model itself, which was conceptually derived from the telecommuting literature, is provided as Figure 1 towards the conclusion of that section.

This paper reports the results of a test of the portion of the model that relates to the individual student.

BACKGROUND

The proposed adoption model (see below) was based on the benefits costs and risks associated with distance education from the perspective of both the student and the educational institution and the enablers, drives and constraints (Mokhtarian and Salomon, 1994; Tung and Turban, 1996) which provides some insight into the factors that are likely to influence the acceptance of this form of education. The proposed model included as potential benefits or drives:

- Reasons associated with travel for educational purposes, such as not having to attend on a regular basis, may reduce travel costs for the student, particularly if long distance travel is involved. In this context it should be noted that reduction of living costs maybe a significant factor for the potential student. Also, this area might be broadened to include those for whom travel would be impossible, such as those living abroad or in remote areas.

- Better able to manage one's own affairs eg. more independence, flexibility, control of the physical living environment, to pursue personal interests—particular relevance perhaps to the post-graduate student in the sense of better managing work commitments.

- The increased the possibility of education for those who may be disabled or extensively involved in the care of dependent children or other relatives.

- More attractive to those who might find the campus environment threatening or intimidating.

- To spend more time with one's family.

- Campus life offers many distractions for the student; while mostly seen as an advantage, some students may benefit from the possibility of removing themselves from these distractions.

Against these advantages, the following potential drawbacks merit consideration.

- More difficult to study at home due to less help available, motivational problems, increased family conflict and distractions—one might expect these to be serious impediments to distance education for many people, requiring particular personal attributes for them to be overcome.

- The potential feeling among distance students that those with physical access to the academic staff get enhanced help and assistance.

- Missing out on resources and occasional casual work to supplement student incomes.

- Travel is seen as a time for completing assignments, reading, study, etc.

- A significant issue for potential distance students may be the need to equip a home study area with a PC and appropriate software, telephone line, communications software.

- Missing out on the extra-curricular activities that take place on campus could be viewed by many as a serious impediment to distance education.

- Not getting to know one's fellow students, no easy access (formal or informal) to academic staff. At a more strategic level, a diminished educational experience may result.

In addition to the above there is a long list of electronic enablers which facilitate telecommuting—PCs and laptops, printers, modems, copiers, fax machines, cellular telephones, answering machines, high speed communications links and access to e-mail and the Internet (Hotch, 1993; Tung and Turban, 1996). While clearly not all are required for educational tasks, this list is a useful starting point for the types of electronic assistance that would facilitate distance education. At present much of this equipment is made available free of charge to students in the traditional campus environment—considerable expense would be incurred by the student in equipping himself with such technology. On the other hand many universities are moving to requiring (or expecting) students to have such technology available at home.

Parallels were drawn between educational and work-place tasks—the understanding of prescribed material, assignments, experiences and acquisition of knowledge on one hand and the components of a job on the other. Using a theoretical task model to encompass the component, co-ordinative and dynamic themes of complexity (Wood, 1986), the task characteristics of uncertainty and equivocality (Daft and Macintosh, 1981) and the organisational issues of resources and scheduling of work (Thompson, 1967), a set of attributes for educational tasks was developed. It was proposed that this model form a central component of a research model for the evaluation of the suitability of educational tasks to distance education.

Considering the complexity of tasks (Wood, 1986)—in general terms as the degree of complexity rises, the task becomes less suitable (or more difficult) for distance education. Component complexity is a function of the number of distinct acts that are required to perform the task and the number of information cues to be processed in performing these acts. Component complexity is also affected by the task being dependent on completion of other tasks. The type of task may have relevance here too—some concepts may be difficult to explain or demonstrate without "hands on" experience—for example dissection, modelling and instrument operation. Co-ordinative complexity refers to the form and strength of relationships and the sequence of inputs. Wood suggests that the more complex the timing, frequency, intensity and location requirements, the greater the knowledge and skill the individual must have to be able to perform the task. Changes in the acts and information required or in the relationships between inputs and products Wood calls dynamic complexity. This too can create shifts in the knowledge or skills required.

To illustrate, if we consider component complexity, tasks with minimal component complexity may be those such as reading a study guide, notes or a textbook and answering a series of "review" questions. At the other end of the scale, research using multiple resources, including hard copy and electronic journals, textbooks and the Internet, discussions with a colleague and writing up a summary of the research may present difficulties for the distance education student. Likewise, co-ordinative complexity could range from one person completing an assignment to working as part of a team, with each member responsible for various components and then the team having to link them together to produce a final product.

The task characteristics (Daft and Macintosh, 1981; Daft, Lengel and Trevino, 1987) of equivocality (ambiguous meanings or instructions) and uncertainty (about what is required or how to go about it) are relevant to tasks involved in distance education too—considerable difficulty might be expected to be experienced by the student if tasks are not clearly explained with no ambiguity and specified to reduce uncertainty.

Similarly, the environment in which the tasks take place (Thompson, 1967) may have some relevance to their suitability—serial dependence refers to the need to wait on others (academic or student) in order to commence or complete one's own work . Also relevant is the degree of "networking" and team building that educational tasks are designed to include.

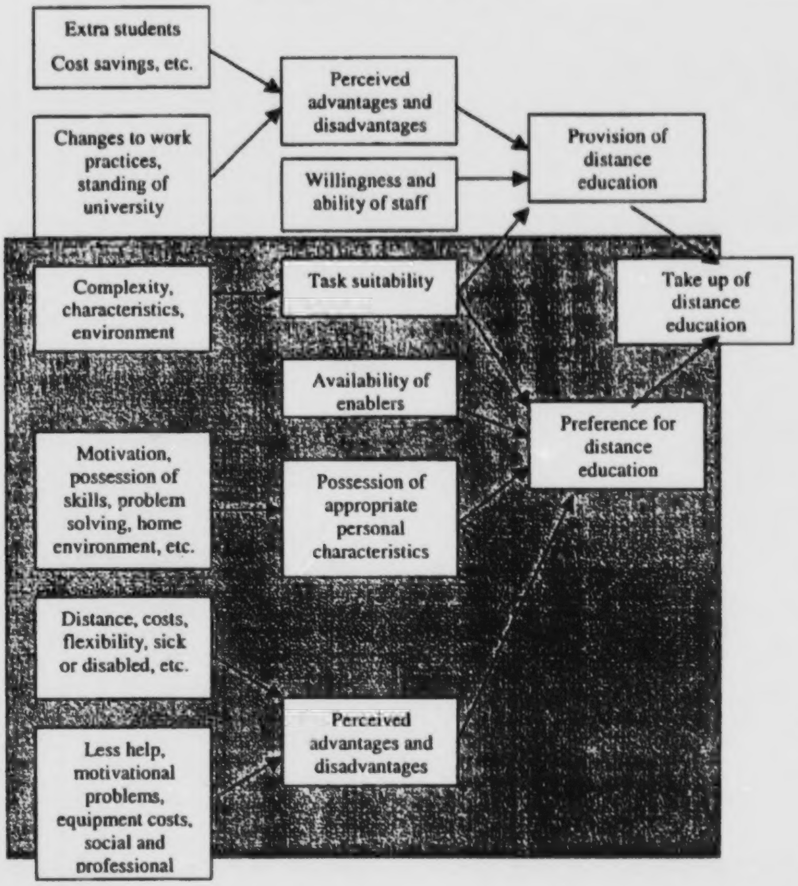
The personal attributes of the individual student would seem to have relevance too. These are most likely to be in the areas of characteristics such as the ability to get information required, knowing when advice is needed, the ability to solve one's own problems and good self-management (Venkatesh and Vitalari, 1992; Gray, Hodson and Gordon, 1993; Wheeler and Zackin, 1994; Mokhtarian and Salomon, 1996) and the home environment (Yap and Tng, 1990; Mannering and Mokhtarian, 1995). For the distance student, knowing where to get relevant information and when to seek advice would seem to have particular importance, as does the ability to solve his own problems—the added reliance on information technology and communications equipment gives this aspect added weight. Undergraduates are more likely (perhaps than their post-graduate counterparts) to have motivational problems and will need to develop time management skills to enable work of an appropriate quality to be delivered on time. On the subject of the household environment, the telecommuting issues (Mannering and Mokhtarian, 1995) of presence of small children, number of people in the household and family orientation may also have some effect on the preference to study at a distance.

To some extent the role of the academic is analogous with that of the supervisor. As the supervisor controls allocation, timing and resources for tasks (Starr, 1971), the academic controls task content, timing and the required resources and becomes an important point of contact and resource for the student.

Telecommuting literature also provides some pointers to demographic influences on the preference to telecommute—age, gender, time in the work-place, job type, education, transport, presence of small children and the number of cars in the household (Mokhtarian and Salomon, 1997; Belanger, 1999; Dick and Duncanson, 1999)—some of these seem to have relevance to the decision to engage in distance education.

The perspective of the educational institution, plus the above issues led to the development of a proposed model to assess the likely adoption of distance education, shown in Figure 1 below. The above issues, which are grouped together as a basis for a series of constructs on the left-hand side of the model are represented as variables in the data collection instrument (see Appendix A). The research reported in this paper deals with shaded portion of the model only.

FIGURE 1
THE RESEARCH MODEL


Extra students
Cost savings, etc.
Changes to work practices, standing of university
Perceived advantages and disadvantages
Willingness and ability of staff
Provision of distance education
Take up of distance education
Complexity, characteristics, environment
Task suitability
Availability of enablers
Preference for distance education
Motivation, possession of skills, problem solving, home environment, etc.
Possession of appropriate personal characteristics
Distance, costs, flexibility, sick or disabled, etc.
Less help, motivational problems, equipment costs, social and professional
Perceived advantages and disadvantages

In the distance education literature there is considerable support for the above issues - accessibility, convenience, international (or recognised) instructors and a "consumer orientation" (Alavi, Yoo and Vogel, 1997; Emmons, 1999), and the ability to continue education or keep up to date while having only limited time available due to heavy work commitments (Jana, 1999; Boisvert, 2000). Likewise, many of the potential disadvantages—there is broad support for the notion that an educational programme is far more than a curriculum and that there are benefits from a "surround interaction" between the students, the instructor and the lectures. This rich variety of interaction is likely to be lost (Bertagnoli, 2001). Others include not learning the skills to think on one's feet, the absence of support and help, longer to develop a rapport between student and professor and cost issues related to tuition and technology (Emmons, 1999).

Attempts to measure satisfaction with distance education have been sporadic, other than the measure of enrolments and the growth in the number of institutions offering some form of distance education. One recent approach using the service industry as a base (Long, Tricker, Rangecroft and Gilroy, 2000) based the assessment largely on immediate application in the work place—not in an invalid measure, but perhaps only one of many.

THE DATA

The data collected for this study comes from five sources—although this is the first test of this model and to some extent must be considered a pilot study, the following groups, reflecting as they do different cultures, levels of study and varying experiences with distance education, provide for considerable comparative analysis.

METHODOLOGY

The researchers designed the initial survey instrument after careful consideration of the issues raised in the literature and reflected in the above model. A copy of the instrument may be found at Appendix A. The basic structure of the survey instrument measured perceptions in the following areas.

Section	Contents
1	Advantages of distance education
2	Disadvantages of distance education
3	Education related tasks
4	Ability to undertake distance education
5	Suitability of distance education
6	Personal demographics

To check for ambiguity, its ability to be understood, and the amount of time taken to complete, a member of academic staff and 4 students completed this survey. No modifications were made to the survey instrument as a result of the review of the completed surveys.

It is recognised that the disparate data groups listed in Table 1 cannot be considered to form a homogenous group for evaluation of the model and its underlying constructs, however it is considered that it is acceptable to combine the groups for the purposes of instrument validation.

Reliability of the instrument in terms of stability was measured by test-retest surveys and in terms of construct validity by Cronbach alpha scores to determine internal-consistency reliability. This is a generally accepted procedure (Judd et al. 1991; Frankfort-Nachmias and Nachmias, 1996). There is considerable support for the use of the test-retest procedure to ensure that the answers are stable and there is minimal noise in the measurement process at the individual level. The Cronbach alpha is now the preferred measure of internal-consistency reliability for construct measurement and is performed by analysing the statements in the survey (Judd et al. 1991). In this study, both were used. 80% of the test-retest correlations were greater than .68 and all were significant at the .001 level. The Cronbach alpha scores ranged between .70 and .81 for each of the constructs, falling into the "respectable" to "very good" ranges (DeVellis, 1991).

Validity of the measurement instrument was assessed in terms of content validity, (specifically including face validity and sampling validity), empirical validity and construct validity. This methodology is in accordance with generally accepted procedure (Frankfort-Nachmias and Nachmias, 1996). Specific procedures conducted to assess each of these were:

- Face validity (a necessarily subjective assessment of the instruments' appropriateness) was assessed and achieved by the researchers by comparing the instrument with other, similar telecommuting

TABLE 1
DATA GROUPS

Group	n	Description
A	159	Predominantly first and second year undergraduate students at a US university doing an introductory IS course
B	49	Predominantly final year undergraduate students at a US university doing a database course
C	18	MBA-type students at an Australian University doing an IS Management course face-to-face on campus
D	29	MBA-type students at an Australian University doing the same course as Group C (different instructor) via a web based education package—interaction with the instructor was largely limited to this package and email.
E	31	MBA students at a US University doing an IS Management course face-to-face on campus and others doing the same course (and the same instructor) with some students at remote locations interacting via full tele-conferencing facilities

surveys and questionnaires, in particular studies based in the US.

- Sampling validity (whether a given population is adequately sampled by the measuring instrument) was provided by the distribution of the survey to all members of a class and by the researcher not following any particular bias in selection of the students to whom to distribute the survey. The large sample size in group A goes some way to ensuring sampling validity, too.

- Empirical validity was evaluated both by using measures contained within the survey to check the consistency of results.

- Construct validity was assessed by means of Cronbach alpha scores.

In order to assess the effect of each of the independent variables on the preference for distance education, linear regression was performed on the data. Also a series of non-parametric t-tests (Mann-Whitney) was conducted to identify variations in the perceptions and preferences between the different groups of students in the data.

RESULTS

Undergraduate Students

The data contained two groups of undergraduate US students, one group predominantly freshman and sophomores doing a face-to-face introductory IS course, the other predominantly seniors doing a face-to-face database course. It was hypothesised that these two groups would see the advantages and disadvantages in a similar light, but that the seniors would see more complexity, ambiguity and communication requirements in their course, which, it was expected, would make such a course seen as less suitable for distance education.

The results of a series of Mann-Whitney tests only partially support this hypothesis. While the students do see the advantages and disadvantages in a similar light (the responses to only two of the statements were significant at the .05 level) and the senior students saw much greater task complexity, ambiguity and communication and interaction requirements (7 items significant at the .05 level) the two groups viewed the tasks associated with their course as being suited to distance education in a similar fashion. In addition this group agreed with the statement that while distance education was an acceptable instructional delivery system, it fell short of the traditional classroom experience.

In terms of the preference to undertake distance education (and most of these students disagreed with the statement that they would prefer distance education over traditional classroom based courses—a mean of 3.52 in a 5 point scale from "strongly agree" to "strongly disagree"), regression analysis, (using stepwise regression, initially computed by running each section against the dependent variable, then by running the variables that loaded against the independent variable) suggests that for this group of students, the significant elements ($R^2 = .31$) are:

- more help available on campus,
- distractions at home,
- not seeing distance education as providing long periods of concentration time,
- a diminished classroom experience, and
- the absence of computing and communications resources in the home.

Post-graduate Students—Australia

Two groups of students undertaking the same MBA-type course in Australia were included in this study. One group of students took the course in a traditional environment with a weekly discussion group facilitated by a professor, the other group completed the course by distance education, which in this context means being given a hard-copy of notes and readings (as were the face-to-face group) and then interacting with each other via an Internet-based discussion group (facilitated by a professor) and email. Both groups submitted assignment work electronically. Due to nature of the delivery of this course and the mix of students involved it is reasonable to assume that each group had either some experience or some knowledge of the other form of delivery.

The distance education group saw the advantages and disadvantages differently to the classroom based group. They felt that the advantages of being able to manage work commitments, flexibility and being able to choose the time for educational work applied much more strongly to them that the classroom based group did. They also saw the potential disadvantages of the difficulty of studying at home, better help on campus, missing out on the professional interaction, the possible diminished classroom experience and difficult to contact the instructor all less strongly than the traditional group. These differences were all significant at the .05 level. The groups showed no differences in the way they viewed the task related activities or their abilities to undertake distance education.

Turning to the ways the two groups viewed distance education, marked variations were noted. In terms of distance education being of lesser quality than traditional classroom education, the traditional group agreed, the distance group did not ($p < .001$). The traditional group indicated they would only participate in distance education if they could not attend campus classes, the distance group disagreed ($p < .05$). The traditional group did not see the tasks as suitable for the distance education environment, the distance group did ($p < .05$). The traditional group would not encourage others to use distance education, the distance group would ($p < .05$). The traditional group did not prefer distance education and saw it is as falling short of the classroom experience the distance group disagreed with both of these ($p < .001$ in both cases). For the distance group, the mean was 3.18 indicating neutrality. It is also worthy of note that the traditional group were less likely to believe they had the skills and ability to be a successful distance education student.

For the traditional group, considering the (non) preference for distance education (a mean of 4.06 in a 5 point scale, where 5 = "strongly disagree") regression analysis suggests that for this group of students, the significant elements ($R^2 = .59$) are:

- missing out on benefits available on campus, and
- not seeing the ability to choose a time for study as important.

For the distance group, considering the preference for distance education (a mean of 2.57 in the 5 point scale,) regression analysis (performed as outlined above) suggests that for this group of students, the significant elements ($R^2 = .54$) are:

- being able to concentrate for long periods on course related tasks, and
- not feeling that there is better help available on campus.

Post-graduate Students—US

The final group included in the study were two MBA classes in the US—some were taught face-to-face, others in an identical course were taught face-to-face for some students while those in outlying areas joined the class by means of video-conferencing. Again it is reasonable to assume that each group had some knowledge and/or experience of the alternative form of delivery.

This group was the group most opposed to distance education—the responses to the statement "I prefer distance education over traditional education" gave a mean of 4.1 on the 5 point scale. An examination of the data indicates that it is bi-modal with 55% choosing "strongly disagree" (5) and 30% choosing the middle of the range (3). They agreed with the statement that while distance education was an acceptable instructional delivery system, it fell short of the traditional classroom experience.

Regression analysis (performed as outlined above) suggests that for this group of students, the significant elements determining the preference for distance education ($R^2 = .85$) are:

- a diminished classroom experience,
- not seeing distance education as enabling them to better manage work commitments,
- tasks assigned typically involving many different components (complexity), and
- a preference for working on their own rather than with other students.

Further analysis will be conducted on this group in an attempt to explain these general findings, perhaps due to the small sample size and the bi-modal distribution.

CONCLUSIONS, LIMITATIONS, AND FURTHER RESEARCH

For undergraduate students, distance education is very much a second option, at least in the US environment. While it might suit a small group of students who have the skills, resources and perhaps the need to not attend campus classes, by and large they will miss the help and interaction available there and would incur considerable expense in setting up the necessary computing and telecommunications equipment.

The Australian group clearly demonstrates different perceptions of distance education, based on one's desire for it. The findings are almost completely reversed for the two groups involved in the one course—one group who have chosen to study by distance have chosen it for almost the same reasons as the other group chose to study in a more traditional manner, just a different perception of these reasons.

It is perhaps worthy of note that there is a widespread belief that one should not have to pay as much for distance education as for traditional campus based education and that universities see distance education as attractive because it provides additional revenue without the need for additional resources. This finding holds true for even the group of Australian distance students who expressed a preference for distance education.

An obvious limitation of this study has been the degree of self-selection in the data. Clearly, the students involved in the study have chosen courses that suit them, their skills and their attributes. However, this limitation in itself is useful, demonstrating that students will choose the best option for themselves and adding weight to the belief or conjecture that not all courses are suited to all types of students.

The study does support the model to a considerable degree. The high R^2 scores from the regression analysis suggest that the measurement items are valid for the constructs and that the constructs being tested lead to determining the preference for distance education. More work is necessary in this area, covering a wider range of courses, cultures and students. The authors would welcome collaborating with other researchers to conduct studies in other disciplines and countries.

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APPENDIX A
DISTANCE EDUCATION SURVEY

1. Please indicate the extent to which you agree that the following potential advantages of distance education apply to you:

		Strongly Agree	-> -> -	->->-	->-> -	Strongly Disagree
a.	Distance education allows me to reduce travel and commuting costs.	☐1	☐2	☐3	☐4	☐5
b.	Distance education allows a reduction in living costs due my ability to live at home, not on campus.	☐1	☐2	☐3	☐4	☐5
c.	Distance from home would make class attendance on campus impossible.	☐1	☐2	☐3	☐4	☐5
d.	I am better able to manage work commitments by not being required to attend class on campus.	☐1	☐2	☐3	☐4	☐5
e.	Distance education enables me to complete class work if disabled or taking care of dependents.	☐1	☐2	☐3	☐4	☐5
f.	I find the campus environment intimidating or undesirable.	☐1	☐2	☐3	☐4	☐5
g.	Personal reasons such as family, flexibility make distance education attractive to me.	☐1	☐2	☐3	☐4	☐5

		Strongly Agree	-> -> -	->->-	->->-	Strongly Disagree
h.	Fewer distractions for me at home allows me to be a productive distance education student.	☐1	☐2	☐3	☐4	☐5
i.	Being able to choose the time to study and work on assignments is important to me.	☐1	☐2	☐3	☐4	☐5

Please indicate up to 3 of the above that you see as the most and least important:

	Most important	Least important
1st	______	______
2nd	______	______
3rd	______	______

2. Please indicate the extent to which you agree that the following potential disadvantages of distance education apply to you:

		Strongly Agree	-> -> -	->->-	->->-	Strongly Disagree
a.	I would find it more difficult to study at home due to less help, motivational problems, increased family conflicts, distractions.	☐1	☐2	☐3	☐4	☐5
b.	I feel that there is better help for me available on campus.	☐1	☐2	☐3	☐4	☐5
c.	I would miss out on benefits available on campus—resources, possible employment, etc.	☐1	☐2	☐3	☐4	☐5
d.	The cost of procuring the necessary distance education equipment for my home would be expensive for me.	☐1	☐2	☐3	☐4	☐5
e.	I would miss out on the extra-curricular activities available on campus.	☐1	☐2	☐3	☐4	☐5
f.	Missing out on the professional interaction with one's fellow students would be a concern to me.	☐1	☐2	☐3	☐4	☐5
g.	There would be a diminished classroom experience—less discussion, interaction with professors.	☐1	☐2	☐3	☐4	☐5
h.	I find it very difficult to contact the instructor.	☐1	☐2	☐3	☐4	☐5

Please indicate up to 3 of the above that you see as the most and least important:

	Most important	Least important
1st	______	______
2nd	______	______
3rd	______	______

3. Thinking about your academic work, please indicate your degree of agreement with the following statements as they typically concern course related tasks you have to complete (study, assignment work, exam preparation etc.):

		Strongly Agree	-> -> -	->->-	->-> -	Strongly Disagree
a.	The final product of the tasks that I am assigned typically involves the completion of many different components.	☐1	☐2	☐3	☐4	☐5
b.	My tasks often require me to work with fellow students.	☐1	☐2	☐3	☐4	☐5
c.	Sometimes the task deliverables change over the duration of the assignment (e.g., the instructor adds or deletes one or more components).	☐1	☐2	☐3	☐4	☐5
d.	Tasks I am given are not always clear and may be interpreted in different ways.	☐1	☐2	☐3	☐4	☐5
e.	I am often uncertain about what to do to complete the final product.	☐1	☐2	☐3	☐4	☐5
f.	The tasks I am assigned are often dependent on at least one other student completing his work first.	☐1	☐2	☐3	☐4	☐5
g.	The task deliverables are clear, but can be accomplished in a number of ways.	☐1	☐2	☐3	☐4	☐5
h.	I would typically rather work on my own, than with other students.	☐1	☐2	☐3	☐4	☐5
i.	The tasks I am assigned require minimal resources (e.g. software, library, etc.).	☐1	☐2	☐3	☐4	☐5
j.	The tasks I am assigned allow me to work at my own pace.	☐1	☐2	☐3	☐4	☐5
k.	Assigned tasks require long periods of concentrated attention.	☐1	☐2	☐3	☐4	☐5
l.	Distance education enables me to concentrate on course related tasks for long periods.	☐1	☐2	☐3	☐4	☐5
m.	"Due dates" for tasks assigned are clearly stated.	☐1	☐2	☐3	☐4	☐5
n.	There is a need for a considerable degree of communication with my fellow students.	☐1	☐2	☐3	☐4	☐5
o.	There is a need for a considerable degree of communication with academic staff.	☐1	☐2	☐3	☐4	☐5

4. Thinking about your ability to study via distance education, please indicate your degree of agreement with the following statements:

		Strongly Agree	-> -> -	->->-	->-> -	Strongly Disagree
a.	I am capable of making good decisions about the tasks I am assigned.	☐1	☐2	☐3	☐4	☐5
b.	I know where to get the relevant information I need to complete the assigned tasks.	☐1	☐2	☐3	☐4	☐5

		Strongly Agree	-> -> -	->->-	->-> -	Strongly Disagree
c.	I have no difficulty determining when I should seek advice.	☐1	☐2	☐3	☐4	☐5
d.	I am good at self management, possessing the motivation, time management, etc. that is needed to deliver quality work on time.	☐1	☐2	☐3	☐4	☐5
e.	I have the computing and communications resources I need to be an effective distance education student.	☐1	☐2	☐3	☐4	☐5

5. Please indicate the extent of your agreement with the following statements:

		Strongly Agree	-> -> -	->->-	->-> -	Strongly Disagree
a.	Distance education is of lesser quality than traditional class-room-based campus education.	☐1	☐2	☐3	☐4	☐5
b.	I only participate in distance education because I can't attend campus classes.	☐1	☐2	☐3	☐4	☐5
c.	The tasks associated with my course are suitable for the distance education environment.	☐1	☐2	☐3	☐4	☐5
d.	I should not have to pay as much for distance education as for traditional campus based education.	☐1	☐2	☐3	☐4	☐5
e.	I would encourage most professionals to participate in distance education.	☐1	☐2	☐3	☐4	☐5
f.	Instructors should not assign the same tasks to distance based students as they assign to campus based students.	☐1	☐2	☐3	☐4	☐5
g.	Distance education courses are designed with the distance student in mind.	☐1	☐2	☐3	☐4	☐5
h.	I believe I have the skills and ability to be a successful distance education student.	☐1	☐2	☐3	☐4	☐5
i.	Distance education is attractive to Universities because it provides additional revenue without the need for additional resources.	☐1	☐2	☐3	☐4	☐5
j.	I prefer distance education courses over traditional classroom based courses.	☐1	☐2	☐3	☐4	☐5
k.	Distance education is an acceptable instructional delivery system, but it falls short of the traditional classroom experience.	☐1	☐2	☐3	☐4	☐5

6. Please provide the following general information about yourself:

1. Are you :
   ☐ Male ☐ Female

2. In which age group are you?
   ☐ 20 or younger ☐ 21 - 25 ☐ 26 - 30 ☐ 31 - 40
   ☐ 41 - 50 ☐ 51 - 60 ☐ over 60

3. Postcode/Zip code .... Home .... Work (or country if overseas..............................)

4. What is your education level? *(Indicate highest level, excluding current courses of study)*
☐ High school ☐ Technical certificate or diploma
☐ University graduate ☐ Post-graduate ☐ Other (please specify)________
Year completed? _________

5. Which of the following best describes your current work?
☐ Manager/Administrator
☐ Professional
☐ Supervisor
☐ Services/Repair
☐ Sales/Marketing
☐ Other (Please specify) _____________
☐ Administrative support
☐ Technical
☐ Clerical
☐ Customer enquiry
☐ Education

6. How many people in your household (including yourself) fall into each of the following age groups:
_____ Under 2 years old _____ 2 - 5 years old _____ 6 - 15 years old
_____ 16 - 20 years old _____ 21 - 65 years old _____ over 65 years old

SERVQUAL-BASED MEASUREMENT OF STUDENT SATISFACTION WITH CLASSROOM INSTRUCTIONAL TECHNOLOGIES: A 2001 UPDATE

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ABSTRACT

The researchers, using a variation of the SERVQUAL instrument, repeated a 1999 study to measure students' satisfaction with instructional technology tools used in their classrooms. Student satisfaction varied by course discipline, by instructional technology, by anticipated grade, and by frequency of use. Female respondents were less satisfied than male respondents. Satisfaction generally rose with frequency of use. There are significant variations of satisfaction by discipline and technology choice, but little interaction effect. Factor analysis did not reveal the five hypothesized dimensions of SERVQUAL. Overall results were generally consistent with the 1999 study.

INTRODUCTION

The researchers, using a variation of the SERVQUAL instrument, repeated a 1999 study and measured students' satisfaction with a broad spectrum of classroom technology tools. Classes in five academic courses Introductory MIS, Business Communication, Principles of Economics, Principles of Marketing, and Accounting Information Systems in AACSB-accredited schools nationwide, participated.

Purpose

Higher education institutions across the country are scrambling for competitive advantage, whether through distance education offerings or in their traditional "brick and mortar classrooms. High service quality is necessary to protect competitive advantage. Student satisfaction with their classroom experiences plays an important part in contributing to a school's competitive advantage. This research replicates a 1999 study (Kleen, Shell, and Cox, 1999) of a cross-disciplinary student-centered assessment of satisfaction with instructional technology being used in the business classroom. The 1999 study used an instrument inspired by SERVQUAL, a widely used instrument to measure customer service quality. The undercurrents of the research include such academic problems as limited technology dollars, questionable relevance of industry training room setups as models, and the need for classrooms to support several faculty with different teaching styles and different technology needs. This research is also inspired by the need to evaluate new and evolving technologies with uncertain cost-benefit ratios and relatively untested classroom impact.

The long-range intent of the researchers is to provide faculty with evidence to help them choose instructional tools appropriate to their classes. The current researchers elected to conduct the 2001 study for two reasons: (1) to review technologies after three years and compare whether students are now more satisfied or less satisfied with the technologies used in the classrooms than in 1999, and (2) to corroborate the results of the Kleen, Shell, and Cox 1999 study.

The Kleen, Shell, and Cox 1999 study revealed that students in the various disciplines did have different levels of satisfaction with various technologies such as overhead transparencies, computer slide shows, software demonstrations, and student in-class computer activities. The authors found that satisfaction varied little by gender or by respondent age group, although satisfaction varied with intensity of technology use in some ways. In a related study by Kleen, Shell, and Zachry (2001), the researchers found that male students in AIS classrooms were uniformly less satisfied than female students with certain technologies.

Even though the project is a replication of an earlier study, the research questions are cross sectional. What are the top rated satisfaction items for the various technologies? What are the satisfaction differences across course disciplines? Are there interactions by gender? How satisfied are the student consumers of instructional technology being used in the business classroom? When these modern technologies are used in the classroom, do students believe they learn more? Do they believe they pay attention better? Do they believe they become more confident about their learning? Do they believe they understand more? In the conclusions, parallels will be drawn between the 1999 study findings and the 2001 findings.

Literature Review

To date, a very limited amount of empirical research exists related to how students benefit (or *perceive* they benefit) from faculty use of technology tools and/or methods such as electronic slideshows, Internet activities, live software demonstrations, and hands-on student computer activities within the actual classroom.

The 22-item, two-part scale called SERVQUAL, originated by Parasuraman, Zeithaml, and Berry (1988), has become a widely used tool for measuring customer service quality. Buttle (1996) emphasized that service quality can be best assessed from the point of view of consumers; this is the approach taken by SERVQUAL. Kettinger and Lee (1997) noted its practical value as both a benchmarking tool within an industry and as a diagnostic tool. While SERVQUAL studies have covered many service sectors, Buttle (1996) found no articles that applied SERVQUAL to a classroom setting. Modifications and adaptations of the SERVQUAL instrument are widespread; in fact, even the instrument's originators have tested modified versions (Parasuraman, Zeithaml, and Berry, 1996). In 1997 Van Dyke, Kappelman, and Prybutok concluded that using a single measure of service quality across industries is not feasible, and that future research should involve development of industry-specific measures of service quality.

Kleen, Shell, and Cox (1999) focused only on perceptions of students as consumers of classroom technology, eliminating the use of gap-based scores of perception minus expectations (P-E gap scores) of the original SERVQUAL. This use of only part of the SERVQUAL structure, such as omitting expectations but leaving perceptions, is supported by Teas (1994) and Brown, Churchill, and Peter (1993). Additionally, Van Dyke, Kappelman, and Prybutok (1997) note the IS-adapted SERVQUAL instrument, utilizing difference scores, is neither a reliable nor a valid measurement for operationalizing the service quality construct for an information systems services provider.

The research and debate over the use of IS-adapted SERVQUAL instruments in the information systems construct continues (Kettinger and Lee, 1997; Pitt, Watson, and Kavan, 1997; VanDyke, Prybutok, and Kappelman, 1999). The research and debate over the use of SERVQUAL-inspired instruments in the higher education construct should do no less.

Methodology

The researchers repeated an earlier study that used an instrument containing 19 questions inspired by SERVQUAL. These items are not "difference-score based or "gap-based, but rather focus only on the *perceptions* of students as consumers of classroom instructional technology. They do not include student expectations of desired or adequate service. The original 19 satisfaction items on the questionnaire remained the same as the Kleen, Shell, and Cox 1999 study. The researchers added an explanatory variable of self-reported projected final grade in the course to the other classification variables of major, age, and gender. The 1999 study contained the classification variable, "student classification. This variable was not used in the 2001 study for its lack of explanatory power. Students in AACSB schools were the target population. The current research project received approval from the researcher University's Human Subjects Institutional Review Board.

The researchers conducted a systematic random sample of one-third of the approximately 350 AACSB-accredited schools. Department heads were contacted for each of five business courses selected for the study. Specific courses selected included the following: Management Information Systems, Business Communication, Principles of Economics, Principles of Marketing, and Accounting Information Systems. Each department head received a cover letter from the researchers and letters of invitation to distribute to the faculty teaching the course identified in the letter. Because of the known wide variance in the departments responsible for business communication, these materials were sent to deans' secretaries for routing to involved faculty. Faculty members who wished to participate after reading the letter of invitation e-mailed course name, number, and number of students to the researchers. The researchers then mailed survey instruments and response forms for each student in the classroom of participating faculty in April. Faculty members were encouraged to administer the survey near the end of the term.

The current study used only four of the seven instructional technologies of the 1999 study. The categories of overhead transparencies, videotape or television programs, and CD-ROM or multimedia presentations were eliminated from the current study because two were rarely used in 1999. The current researchers also wanted to focus on only those technologies with an electronic component. The primary focus of the instrument was on the four remaining classroom instructional technologies:

electronic slide shows
live software demonstrations
live Internet connections
student in-class computer activities

Participating instructors selected two of the four technologies used in their classes and directed students to answer the question sets for those specific technologies.

Parallel sets of 20 questions were presented for each instructional technology. Eighteen of the twenty questions were built around the five SERVQUAL dimensions of Tangibles, Reliability, Responsiveness, Assurance, and Empathy. Students responded based on a five-point Likert-type scale, assumed by the researchers to generate interval data. The 19th item was a global item. The final question (20) asked the student to estimate in what percentage of the class meetings a particular technology was used so that the researchers could determine how satisfaction varied with intensity of use.

The 20 questions students responded to for each technology are listed below. Students responded to a five-point scale, with answer options ranging from a strongly agree (1) to a strongly disagree (5).

1. The use of _________ made it easy to see the material presented.
2. The use of _________ was not appropriate in this class.
3. The use of _________ helped me learn the material presented.
4. The use of _________ was a good way to reinforce assigned reading material.
5. __________________ worked when it was supposed to.
6. The use of _________ helped me pay attention in class.
7. The use of _________ was distracting.
8. The use of _________ helped make this course more interesting.
9. The use of _________ allowed me to focus better on what the professor was saying.
10. The use of _________ was more trouble than it was worth.
11. The use of _________ made me more confident about what I was learning.
12. The use of _________ helped me to better understand fundamental course concepts.
13. The use of _________ tended to oversimplify lectures.
14. The use of _________ helped me "keep up with lecture.

15. The______________ used in this class was visually appealing.

16. The use of ________ helped me organize my lecture notes.

17. The use of ________ helped me understand the lecture material.

18. ________________ is a modern, up-to-date lecture method.

19. I wish more of my instructors used _________ in their classes.

20. ________________ was used in approximately ____ percent of the meetings of this class.

Items 2, 7, 10, and 13 were negative in nature. For purposes of analysis, absolute scores were inverted to be comparable to positively worded items.

Descriptive statistics for the 2001 data will answer a variety of investigative questions. Descriptive statistics included the mean scores for each of the 19 satisfaction-based items, in each of the technology groups, in the aggregate, and in various subgroups such as mean scores by gender, by course discipline, and by anticipated grade. Descriptive statistics also included regression as a descriptive device. These descriptive statistics were used to illustrate:

Which items get higher mean scores as they are used more frequently? Which get lower?
Which satisfaction item (among 1 18) showed the highest satisfaction in each technology group? Which the lowest?
Are the top rated items the same based on gender, technology choice, and course discipline?
Do technologies affect user satisfaction in the same manner across the five course disciplines?
Do any items (among 1-18) get higher mean scores as self-reported grade is higher?
Do any technologies score better as self-reported grade is higher?

The researchers also constructed hypothesis tests to answer each of the investigative questions above. The influence of grade and of usage on satisfaction was tested by simple and multiple regression. The impact of satisfaction of discipline and technology was tested by one-way ANOVA and two-way ANOVA. Hypotheses were constructed (overall and grouped by course discipline for each of the 18 items) to determine whether:

Student satisfaction varies with frequency of instructional technology tool use
Student satisfaction varies with gender
Student satisfaction varies with expected grade
Student satisfaction varies with course discipline

Factor analysis enabled the researchers to determine whether the clustering of 18 items matched their *a priori* expectations for classification into the five hypothesized dimensions.

FINDINGS

The findings section of the paper begins with descriptive statistics, followed by regressions, one- and two-way ANOVAs, and factor analysis.

Descriptive Statistics

A total of 280 students from 11 classrooms provided responses for the study. Class size ranged from 20 to 76. Seventy-seven percent of those indicating age were under 25 years old; 22.1% were 25 or older. Of those respondents indicating gender, 47.5% were male, and 52.5% were female. Of those indicating their anticipated grade at end of course, 37.7% anticipated an A, 35.3% a B, 13.5% a C, 2.2% a D, and 0.9% an F. On a 4.0 scale, that is an average of 2.86.

Electronic slideshow technology had the greatest number of responses (243 students, 47.5% of all responses in the study). Items for live software demonstration technology were answered by 85 respondents, 16.6% of the total. Eighty-one students (15.8%) answered items for live Internet connections, and 103 students (15.8%) answered items for student in-class computer activities. The cross tabulation of response frequencies, by course discipline and technology choice, is illustrated in Table 1.

Of the 512 total responses (most of the 280 students responded to two technologies), 64 (12.5%) were from students in business communication classes; 74 (14.5%) were in a principles of economics class. Principles of marketing contributed 73 responses (14.3%); AIS, 53 responses (10.4%); IS courses, 248 responses (48.4%).

"Made it easy to see the material presented received the lowest mean score (1.89), which provided the highest satisfaction over all technologies, all course disciplines, and all respondents. "Modern, up-to-date lecture method was next highest satisfaction with a mean score of 1.96. The items with worst mean score (lowest satisfaction) overall included "tended to oversimplify lectures, (2.74), and "helped me organize my lecture notes, (2.62).

Female respondents had higher average scores than male students, indicating lower satisfaction in 17 of the 19 satisfaction items.

In the business communication discipline, the item with the lowest mean score was "modern, up-to-date lecture method (2.02). In business communication the item that scored lowest satisfaction was "tended to oversimplify lectures (2.89). In economics, the item that scored best was "made it easy to see the material presented (1.66); the item that scored lowest satisfaction was "helped me organize my lecture notes (2.69). Within the marketing discipline, the item "made it easy to see the material presented (1.86) earned the highest satisfaction score. "Tended to oversimplify lectures earned the lowest satisfaction score (3.17). Within AIS, the highest satisfaction was for "modern, up-to-date lecture method (2.11); the lowest satisfaction was for "helped me organize my lecture notes (2.87). Within the IS discipline, the highest satisfaction was for "made it easy to see the material presented (1.83); the lowest satisfaction score was for "helped me organize my lecture notes (2.70).

When each technology was examined, differences also appeared for highest and lowest satisfaction items. For electronic slideshows, the item that had the highest satisfaction level was "made it easy to see the material presented (1.71); the item that scored worst was "tended to oversimplify lectures (2.80). For live software demonstrations, the highest satisfaction item was "made it easy to see the material presented (2.01); the item that scored worst was once again "tended to oversimplify lectures (2.70). For live Internet best was once again "made it easy to see the material presented (2.07); worst was a tie between "tended to oversimplify lectures and "helped me organize my lecture notes (2.80). The highest satisfaction item for student in-class computer activities was "modern, up-to-date lecture method (2.03). The lowest satisfaction item for this technology was "helped me organize my lecture notes (2.83). While these measures are descriptive, not test results, they point out that instructors should consider their discipline as a strong factor in choosing appropriate technology in their classroom.

Two-Factor Descriptives

In this section, the descriptive statistics are reported as a two-factor model of discipline and technology choice. This model does not include the effects of gender, of usage rate, or of grade.

These descriptive statistics use a model which has a general effect, a discipline effect, a technology effect, and an interaction effect. These effects are additive.

Satisfaction score = general effect + discipline effect + technology effect + interaction

This equation will be used to illustrate best case and worst case scores for two of the 18 satisfaction-based items. For item 3, "helped me learn the material presented, the best case is

2.107 - .610 (economics discipline) + 0 (in-class computer activities) = 1.497 (satisfaction).

The corresponding worst case is

2.107 + .393 (AIS) + .719 (live software demonstrations) = 3.219.

TABLE 1
NUMBER OF RESPONSES BY INSTRUCTIONAL TECHNOLOGY AND COURSE DISCIPLINE

Technology	Course Discipline					
	Business Communications	Principles of Economics	Marketing	Accounting Information Systems	Information Systems	Totals
Electronic Slideshows	32	37	48	25	101	243
Live Software Demonstrations	0	37	25	0	23	85
Live Internet Connections	0	0	0	14	67	81
Student In-Class Computer Activities	32	0	0	14	57	103
Totals	64	74	73	53	248	512

Similar applications for item 17, "helped me understand the lecture material, produce

2.286 - .478 (marketing) + 0 (in-class computer activities) = 1.808 (best case)

2.286 + .214 (AIS) + .453 (live software demonstrations) = 2.953 (worst case).

Impact of Anticipated Grade on Satisfaction

The researchers conducted a regression analysis on satisfaction scores of each of the 18 items for each of the four technologies, where the independent variable was anticipated grade. The vast majority of all such regressions showed no significance. However, the technology choice student in-class computer activities contained virtually all instances of significance. A typical example follows: For "helped me understand fundamental course concepts, the resulting regression equation is satisfaction = 1.601 + .442 x anticipated grade (sig. = .004, r^2 = .084). In all instances of significance, the regression slopes were positive, meaning lower grade anticipated equaled lower satisfaction.

Impact of Technology Usage Rate on Satisfaction

Item 20 contained a five-valued usage variable. A simple regression of each of items 1 through 18 was conducted with item 20 as the independent variable. This was repeated separately for all four technology choices. In all cases where the regression was significant, the calculated slope was negative, meaning higher usage led to higher satisfaction. While significant, the explanatory power of these models is limited r^2 were typically under 10% for these models. All items for which the regression was significant at the .05 level or better are identified in Table 2.

Does Satisfaction Vary by Technology?

The following section describes a one-way ANOVA to test the equality of mean satisfaction scores across the four instructional technologies. The fundamental hypothesis is

H_o = Mean satisfaction score for an item is the same across all technology choices.

H_a = At least one mean satisfaction score differs from the others.

This hypothesis is applied for all the 18 satisfaction items. H_o was rejected for items 1, 2, 4, 5, 7, 9, 10, 14, 16, 17, and 18. In these cases, post hoc comparisons were done to determine which mean (s) differed.

For the item "made it easy to see material presented, electronic slideshow (mean = 1.71) scored higher satisfaction than both student in-class activities (2.08) and live Internet connections (2.08). A low score reflects higher satisfaction. No other paired differences were significant.

For "appropriate technology for the class, the only significant paired comparison revealed live software demonstrations (2.49) were viewed less appropriate for the class than electronic slideshows (2.00).

For the item "good way to reinforce assigned reading material, electronic slideshows (2.25) scored higher satisfaction than live software demos (2.57). No other paired differences were significant.

For the item "worked when it was supposed to, electronic slideshows (2.06) scored higher satisfaction than live Internet connections (2.55) and student in-class computer activities (2.39). For the item "technology worth the trouble, the only significant paired comparison revealed live Internet (2.58) was viewed with less satisfaction than electronic slideshows (2.20).

For the item "helped me keep up with lecture, electronic slideshows (2.24) scored higher satisfaction than live Internet (2.58). For the item "helped me organize my lecture notes, electronic slideshows (2.42) scored higher satisfaction than live Internet (2.80) and student in-class computer activities (2.83). For the item "helped me understand the lecture material, electronic slideshows (2.33) scored higher satisfaction than live Internet (2.69).

For "distracting technology, "allowed me to focus better on what the professor was saying, and "modern, up-to-date lecture method, ANOVA indicated not all items were equal, but post hoc comparisons did not reveal which.

Does Satisfaction Vary by Course Discipline?

The following section describes a one-way ANOVA to test the equality of mean satisfaction scores across the five course disciplines. The fundamental hypothesis is

H_o = Mean satisfaction score for an item is the same across all course disciplines.

H_a = At least one mean satisfaction score differs from the others.

This hypothesis applied for all 18 satisfaction items. H_o was rejected for the following items: 1, 2, 3, 5, 9, 10, 13, 15, 16, and 17. On these items follow-up tests were

TABLE 2
TECHNOLOGY USAGE RATE AND ITS IMPACT ON SATISFACTION

Item	Electronic Slideshows	Live Software Demonstrations	Live Internet Connections	Student In-Class Computer Activities
1. Made it easy to see material presented	X		X	X
2. Technology appropriate for class	X		X	X
3. Helped me learn material presented	X		X	X
4. Good way to reinforce assigned readings	X			X
5. Worked when supposed to			X	
6. Helped me pay attention in class			X	X
7. Distracting technology	X			
8. Helped make course more interesting				X
9. Allowed me to focus on what professor said				X
10. Technology more trouble than it was worth	X			
11. Made me more confident about what I was learning				X
12. Helped me better understand course concepts				X
13. Tended to oversimplify lectures				X
14. Helped me keep up with lecture				X
15. Technology visually appealing	X			X
16. Helped me organize lecture notes				X
17. Helped me understand lecture material	X			X
18. Modern, up-to-date method	X			X

conducted to see which course disciplines scored better or worse than others on each specific item.

Paired comparisons for item 1, "made it easy to see material presented, revealed that the AIS mean (2.34) was different from the mean for principles of economics (1.66) and the mean for information systems (1.83). Therefore, AIS students were much less satisfied than economics or IS students on this item. While the result was statistically significant, the researchers urge that the finding be treated with caution as AIS was the smallest of the responding groups.

For item 2, "appropriate technology for the course, marketing students (2.68) were less satisfied than economics students (2.01) and information systems students (1.93). Information systems students were more satisfied than AIS students (2.49).

For item 3, "helped me learn the material presented, AIS students (2.68) were less satisfied than information systems students (2.24).

For "worked when it was supposed to, economics students (1.85) were more satisfied than all other disciplines (all 2.23 or greater).

For "tended to oversimplify lectures, the marketing respondents were less satisfied than students in economics or information systems. For "helped me organize lecture notes, marketing students (2.23) differed from information systems (2.70) and AIS students (2.87). In this instance, marketing students were more satisfied than the other two groups.

For "allowed me to focus better on what the professor was saying, "worth the trouble, "visually appealing, and "helped me understand the lecture material, while ANOVA indicated not all means were equal, the post hoc comparisons did not reveal a distinguishable pair of means.

Factor Analysis

The researchers used the rotated component matrix within SPSS's data reduction tools. Using the same *a priori* listing as in Kleen, Shell, and Cox (1999), the researchers assigned the items to the following dimensions: Reliability, items 2, 5, and 10; Responsiveness, items 8, 9, 13, and 14; Empathy, items 12, 16, and 17; Tangibles, items 1, 7, 15, and 18; and Assurance, items 3, 4, 6, and 11.

Within the technology electronic slideshows, data reduction revealed three factors. These factors loaded as follows: Factor I included items 3, 4, 6, 8, 9, 11, 12, 14, 15, 16, 17, and 18. Factor II contained items 1, 2, 3, 4, 5, 9, and 18. Factor III contained items 2, 7, 10, and 13. Some items loaded onto more than one factor.

The technology live software demonstrations also revealed three factors, which loaded as follows: Factor I contained items 3, 4, 6, 8, 9, 11, 12, 14, 15, 16, and 17. Factor II contained items 1, 5, 15, and 18. Factor III contained items 2, 7, 10, and 13.

Within the technology live Internet connection, four factors were identified, loading as follows: Factor I contained items 3, 4, 5, 8, 9, 11, 12, 16, and 17. Factor II contained items 1, 2, 6, 11, 15, and 18. Factor III contained items 7, 10, and 13. And Factor IV contained item 14 only.

For student in-class computer activities, four factors emerged. These loaded as follows: Factor I contained items 1, 2, 3, 4, 8, 12, and 14. Factor II contained items 5, 6, 9, 11, 14, 15, 16, 17, and 18. Factor III contained items 5, 10, and 13. Factor IV contained items 2 and 7.

For electronic slideshows all items of the Assurance dimension were in Factor I. Three of the Responsiveness items were also in Factor I. All three Empathy items were in Factor I. Two of the four Tangibles items were in Factor I. Reliability was divided between Factors II and III.

For live software demonstrations, all the Assurance dimension items loaded in Factor I; likewise, all the Empathy dimension items loaded in Factor I. Three of the four Responsiveness dimension items also loaded in this factor. Factor II contained two of four Tangibles items. Reliability was again split between Factors II and III.

For live Internet connections, three of four items in the Assurance dimension loaded in Factor I. Once again, all the Empathy dimension items loaded in this same factor. Two of the four Responsiveness items also loaded in this factor. Three of four items in Tangibles loaded in Factor II. Reliability's three elements were divided among three factors. The third factor was not associated with any dimension.

For student in-class computer activities, Factor I contained two of four Assurance items and two of the four Responsiveness items. Two of three Empathy items loaded in Factor II; two of four Tangibles items also loaded in that factor. Two of the three Reliability items loaded in Factor III.

In no case did the data reduction identify five factors, as suggested by SERVQUAL theory. The Empathy and Assurance dimensions often combined into the same factor. These two dimensions were also well identified in Kleen, Shell, and Zachry (2001). Otherwise, the data reduction results were inconclusive.

CONCLUSIONS AND RECOMMENDATIONS

The researchers attempted to identify factors affecting student satisfaction with classroom instructional technologies. The study was a replication of 1999 research, with the same instrument, but slightly different instructions, and with different sampling methods. A total of 280 responses, from 11 classrooms, revealed several interesting results.

Satisfaction varies by course discipline.

Satisfaction varies by instructional technology used in the classroom.

There is no significant interaction of discipline and technology.

Gender affects satisfaction. Females were less satisfied than males.

Technology usage rates affect satisfaction generally; more usage equals higher satisfaction.

Anticipated grade affects satisfaction modestly; lower grade equals lower satisfaction.

Factor analysis did not reveal the five theoretical dimensions of SERVQUAL. The researchers found at most four factors; in these the Empathy and Assurance dimensions were generally commingled. The Tangibles dimension could not generally be identified.

The 20 main service satisfaction items were unchanged from 1999 to 2001. The current study used improved instructions for the classroom administration. This aspect was successful. The researchers used a less time consuming, but less personal approach to soliciting participants, and the smaller number of responses suggests the sampling methodology was not as successful.

The researchers used improved statistical techniques with the 2001 data, so the exact time series comparisons were not made. In the 1999 results, male respondents were less satisfied than female respondents; in 2001 this finding is reversed. In 1999, economics students tended to be least satisfied; in 2001, that result fell to AIS. Otherwise, the basic nature of the two sets of results is consistent.

To remove the impact of a relatively small number of classes influencing findings, the study should be repeated with large numbers of students in each course discipline and technology group.

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A FRAMEWORK FOR CONTROLLING CHEATING IN IS EDUCATION

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ABSTRACT

Academic dishonesty among college students appears to be a serious problem at many institutions. The problem may get worse in the future, as the availability of computer technology can make it even easier to cheat than in the past. Due to the nature of computer-based assignments used in information systems (IS) courses, the IS instructor is faced with the challenge of managing cheating among students. The purpose of this manuscript is to introduce a risk assessment framework to help IS instructors develop appropriate controls to address cheating. The framework recommends that four types of controls be used to address cheating: deterrent, preventative, corrective and detective controls. It is suggested that detective controls are especially critical. To illustrate the ideas discussed in the manuscript, an example of an approach to address cheating in an IS course is described. Experiences with the approach are discussed.

INTRODUCTION

Cheating among college students appears to be a problem at many institutions. A recent book by Cizek (1999) summarizes 16 studies on college cheating since 1970, and concludes that the percentage of students who admit to cheating is "remarkably and uniformly high" (Cizek, 1999, p. 21). The studies consistently reveal that over 50 percent of the students admit to cheating on exams or other assessment methods. College cheating is not a new phenomenon— an early experimental study of 126 students in a women's college by Drake (1941) found a cheating rate of 23 percent. However, the proportion of college students who cheat appears to be increasing. A review of the literature by Cole and McCabe (1996) found that the number of students who have admitted to cheating on exams has been rising over the past three decades. A recent study that surveyed more than 6000 college students at 31 campuses found that 70 percent of students surveyed admitted to one or more instances of cheating on an exam (McCabe & Trevino, 1996). For college instructors who teach in the area of business, the findings related to student cheating are even more disturbing. According to McCabe and Trevino (1995), academic dishonesty in undergraduate business programs may be even worse than other areas of study, as undergraduate students aspiring to careers in business self-reported a greater frequency of cheating than their peers in the areas of engineering/science and social science/humanities. These results suggest the emergence of a culture within business schools where some types of cheating are considered acceptable.

As if to add fuel to the fire, the increased use of information technology (IT) in business education offers the potential to make it easier to cheat. Reports in the popular media have highlighted how the Internet and other technologies present new opportunities for cheating (e.g., Kleiner & Lord, 1999). For example, plagiarism is one form of cheating that may be easily supported with technology. WWW sites sporting names like "fastpapers.com" offer simple tools to download prewritten term papers at the click of a mouse. It appears that students are taking advantage of such tools, as these types of sites boast of more than 1 million downloads of term papers since their inception (Clayton, 1999). In this manuscript, we refer to cheating that is facilitated by information technology as "E-Cheating." While tools have been developed to help combat problems associated with E-Cheating (Gilgoff, 2001; Joy & Luck, 1999; Ryan, 1998; Whale, 1990), the potential for E-cheating remains strong.

The trends cited above have important implications for those who teach in Information Systems (IS) programs within business schools. Many IS curriculums rely heavily on electronically based assignments, projects, and exams. Cheating can be a simple act to perform in computer skills courses since a student can simply copy (or cut and paste) portions of the software from a classmate or another source into his or her own submission deliverable. While it can be easy for a student to E-Cheat, it can be very difficult for a teacher to tell the difference between honest work and plagiarized work. For instance, introductory computer skills courses typically require all students to address the same problem using the same data and the same problem specifications. Assignments that require a student to create specific formula features for a spreadsheet or specific tables and queries for a database are likely to result in very similar solutions across students. This presents a situation in which it is very difficult for an instructor to detect—or prove—that cheating has occurred, as the solutions that the students create should be very similar.

What can an IS instructor do to address E-Cheating? The purpose of this manuscript is to introduce a "risk assessment" framework to assist in the development of E-Cheating controls that may be applied to IS courses. The paper is organized into five sections that 1) review the literature on cheating and summarize the variables that are related to increased incidents of cheating, 2) introduce the electronic environment associated with many IS programs and the new vulnerabilities resulting from this environment, 3) propose a framework that can be used to design and evaluate a set of controls aimed at influencing the vulnerabilities, 4) provide an example of a control environment developed using the proposed framework, and 5) summarize our experiences using these controls.

VARIABLES ASSOCIATED WITH CHEATING

One of the first steps in developing controls to reduce the incidence of cheating is determining the factors that influence, or are related to, incidents of cheating. Cizek (1999) reports that prior research has identified more than 100 variables that are associated with cheating on exams. It must be noted that these variables are not necessarily "determinants" and should not be construed as the direct cause of cheating. Rather, these variables are associated with an academic environment that influences the likelihood of cheating.

Cizek classifies these variables as demographic characteristics, psychological constructs (e.g., personality traits, behavioral dispositions, etc.), and classroom instructional and environmental factors. Variables that have been studied (and there correlations with cheating behavior) include the following.

Demographic Characteristics

- Cheating has been inversely related to achievement—students with lower grades are more likely to engage in cheating activity.
- Younger students are more likely to engage in cheating activity than older, non-traditional students.
- Cheating activity is more common among students who are members of Greek social organizations (fraternities and sororities).
- There are no significant differences in cheating activity associated with gender.
- There are no significantrelationships between cheating activity and identification with a religion.

Psychological Constructs

- Strong relationships have been reported between cheating and learning-grade orientation. Specifically, students who are motivated to earn a grade (as opposed to learn) are more likely to engage in cheating activities.
- Other variables that are significantly related to increased cheating behavior include: lenient student attitude about cheating, lower perceived risk of being caught, and the degree to which the student believes cheating is justified.
- While a number of other psychological-oriented variables have been investigated in the literature (e.g., achievement motivation, personality type), the

research findings do not suggest that these variables are strongly related to cheating behavior.

Classroom Instructional and Environmental Factors

- The following variables have all been associated with increased cheating activities: larger class size, free seating, poor supervision of the exam, inexperienced faculty, provision of an opportunity to cheat, and take-home exams.

- The following variables appear to reduce or deter cheating activities: warning about the penalties for cheating immediately before an exam, using different exams with differing questions and answer choices, using essay exams, student perceptions that the exam is fair and maintaining high instructor vigilance during the exam.

- There does not appear to be any relationship between cheating activities and the use of multiple exam forms where the same questions and answer choices are randomly positioned on different versions of the exam.

It is interesting to note that an instructor can directly control the instructional and environmental set of factors listed above. This suggests that instructors can take actions to control cheating in their courses. For example, in a survey conducted by McCabe and Trevino (1995), business students rated the chance of getting caught and the severity of cheating penalties as the major deterrent for cheating. Yet, it does not seem that instructors are effectively controlling the instructional and environmental factors, as student surveys reveal environments where faculty do not detect cheating, and where students who do cheat face trivial penalties (Franklyn-Stokes & Newstead, 1995; McCabe & Drinan, 1999). While over 50 percent of the students surveyed admit to cheating, fewer than 2 percent ever admit to being caught (Haines, et al., 1986; Fishbein, 1994). Cizek (1999) concludes that the current high rates of cheating activity are unlikely to decrease because students perceive that the chance of being caught is slim, and many believe that the chance of harsh punishment is minimal.

Note that this lack of punishment is not due to the lack of institutional policies and procedures. Aaron's (1992) survey of higher education institutions indicated that over 95 percent had an academic integrity code, and over 98 percent had specific procedures for handling allegations of academic misconduct. However, only 7 percent of the institutions reported that faculty members addressed academic integrity policies in their classrooms or course syllabi. Thus, while policies and procedures are well represented in catalogs and handbooks, they are poorly represented in the environments where cheating occurs (i.e., classrooms).

INFORMATION SYSTEMS COURSES: VULNERABILITIES TO E-CHEATING

Since "hands on" assignments and projects provide an important means for assessing a student's understanding of software development (e.g., spreadsheet development, visual programming), many IS instructors rely heavily on electronically based assignments and projects as evaluation tools. Based on our observations and discussions with faculty, many instructors allow their students to complete these electronically-based assignments in uncontrolled, unconstrained and unsupervised environments (e.g., the students are given the assignment and then go off and do it). E-cheating is not difficult to do in such environments. In some cases, IS instructors will also rely on "hands on" types of assignments for exams that are provided on-line to the students. While such exams are typically given in a controlled environment (e.g., a computer laboratory) under instructor supervision, there are still a number of simple approaches that students can employ to share electronic files among themselves (e.g., e-mail, copying files to common areas or remote web sites, etc.). Even in the more restrictive setting of a test environment, high instructor vigilance may not detect the inappropriate exchange of information.

Unfortunately, with regard to the issue of managing E-cheating, it is possible that things may get more problematic for some IS faculty before they get better. As with many areas of the university, IS faculty are starting to teach distance education courses or on-line versions of their courses. Since it can be more difficult to monitor students in the electronic learning environment, and it can be easy to cheat in an environment involving electronic deliverables, distance-learning settings offer the potential for increased opportunities to cheat (Kennedy, et al. 2000). Additionally, most of the institutional academic integrity policies are outdated with respect to information technologies and thus often fail to provide helpful guidelines for students. For example, Kennedy, et al. (2000) report that there appears to be little guidance within institutional policies on the proper use of the

Internet in academic endeavors. While it may be clear what constitutes a plagiarism case for a English writing assignment, it may not be clear to students whether it is acceptable to surf the web to find solutions for a programming assignment.

RISK ASSESSMENT FRAMEWORK

What can an IS instructor do to address the issue of E-cheating? One approach is to perform a risk assessment. A risk assessment requires the evaluation of threats, vulnerabilities and controls (i.e., countermeasures for vulnerabilities). The threat in this case is that cheating will occur. The vulnerabilities are factors that make a threat more likely to occur. In the context of E-cheating, to help identify key vulnerabilities, we may draw from our earlier discussion of the variables identified in the literature that have been associated with increased cheating activity. Lastly, it is necessary to identify controls that may be used to reduce the threat of cheating. There are four general types of controls that may be used as countermeasures: 1) deterrent controls that reduce the likelihood of the threat, 2) preventative controls that protect against the vulnerabilities and reduce the incidents of cheating, 3) corrective controls that reduce the effect of cheating activities, and 4) detective controls that discover whether cheating has occurred. An effective control environment must have a combination of strategies that ensure that all four types of controls are provided.

Developing controls around a single vulnerability (i.e., a variable associated with cheating) may not affect the likelihood of cheating— a blending of controls aimed at addressing multiple vulnerabilities is likely to be more effective. When considering the variables discussed earlier, one finds that an instructor has less control over some variables, and more control over others. For example, the instructor cannot directly influence vulnerabilities resulting from the demographic characteristics of the students. Some of these variables may be influenced at the institutional level—for example, banning Greek social organizations on campus. However, most control environments do not consider demographic vulnerabilities. Some of the psychological constructs can be influenced with prevention strategies. For example, developing group norms in the class supporting honesty is a control directly aimed at influencing student attitudes towards cheating. Using reasonable, interesting, and fair exams is a control aimed toward influencing students' rationalizations that cheating is justified. Also, offering a number of activities for students to demonstrate achievement is a way to reduce grade pressure.

The majority of controls are aimed at influencing the classroom instructional and environmental factors since these types of variables are typically under the control of the instructor. Examples include using a larger facility for exams, maintaining high vigilance during the exam, and using different exams with differing questions and answer choices.

Many studies have been conducted to investigate student perceptions of the effectiveness of various cheating prevention strategies for exams (Evans & Craig, 1990; Genereux & McLeod, 1995; Hollinger & Lanza-Kaduce, 1996; McCable, et al., 1999). The following prevention strategies have consistently been identified by students as strategies that may reduce the incidence of cheating on exams.

- Develop group norms in the class supporting honesty, with stated policies and procedures and high punishment for getting caught (at both the institutional and course level).
- Reduce grade pressure by offering a number of activities for students to demonstrate achievement.
- Write reasonable, interesting, and fair exams. Numerous studies report student perceptions that exams using an essay format are more effective at preventing cheating.
- Use an appropriate testing environment (e.g., a large classroom with students sitting at every-other-seat).
- Maintain high instructor/proctor vigilance during the exam.
- Use alternate forms of the exam.

These suggested prevention strategies can be mapped into three of the four types of controls discussed above.

Deterrent controls reduce the likelihood that cheating will occur. These controls include:

- Institutional policies and procedures are intended to deter cheating—outlining the process and potential consequences if it is determined that academic misconduct has occurred;

- Developing group norms in the class supporting honesty is also intended to deter cheating activities;

- Offering a number of activities for students to demonstrate achievement should deter cheating activities by reducing grade pressures; and

- Finally, when exams are perceived by the students as being reasonable, interesting, and fair, cheating is less likely to occur.

Preventative controls attempt to reduce the incidence of cheating. These controls include:

- Using an appropriate testing environment, such as a large classroom with students assigned to every-other-seat. This reduces the opportunity for students to cheat;

- Maintaining high instructor vigilance during the exam. While it can be argued that vigilance can detect some forms of cheating, the credibility of observational evidence relies on human interpretation of behavior and events. Research indicates that human observations are notoriously fallible (Loftus, 1979). Thus, some other form of substantiating evidence (such as a student admission) is usually needed to fully pursue the consequences for academic misconduct. Thus, we consider instructor vigilance as a preventative control, not a detective control; and

- Numerous studies report student perceptions that exams using an essay format are more effective at preventing cheating. Thus, use of an essay format would be a preventative control.

Corrective controls reduce the effect of cheating. Using alternate forms of the exam, with differing questions and answer choices, has this effect in that it is intended to reduce cheating.

What is missing from these recommended prevention strategies are detective controls. From the student's perspective, this lack of detective controls in the control environment negates the effectiveness of the other controls. For instance, consider the case where a school has an academic integrity policy that clearly outlines the consequences of cheating. Such a policy may not necessarily provide a viable threat if the students sense that the instructor lacks the ability to detect cheating once it has occurred (and thereby lacks the ability to carry out the stated policies and enforce the consequences). We believe that the lack of detective controls contribute significantly to the reported high incidence of cheating on college campuses.

If students perceive that there is a very low chance of being caught, then they are more likely to cheat. Within an electronic environment, this issue is exacerbated, as detective controls appear to be even more difficult to implement.

EFFECTIVE CONTROLS WITHIN AN ELECTRONIC ENVIRONMENT

In this section, we will describe a set of controls designed to deter E-cheating on IS-oriented assignments and exams using the risk assessment framework. To address the issue of E-cheating, we have implemented controls in each of the four areas discussed above. At the deterrent level of control, our institution provides an elaborate set of policies regarding academic integrity, along with specific procedures in the event that academic misconduct occurs. This includes disciplinary counseling for those students who have been found guilty of misconduct. These institutional policies and procedures are summarized in the syllabi of all IS courses.

The first upper-division course within our IS curriculum incorporates a "desktop" application development project using Microsoft Access. Since all students complete the same, highly structured take-home assignments, the detection of unauthorized collaboration and copying is difficult. Since we cannot control this vulnerability, we have reduced the weights of these assignments towards the final grade and encouraged cooperative learning among the students. Thus, we are using a deterrent control to reduce the grade-orientation on assignments and place a higher focus on learning. Recall that a learning orientation has been associated with reduced incidents of cheating.

To evaluate the student's development of appropriate development skills, we have created an evaluation assignment that requires the student to develop a desktop application in Access. The evaluation assignment is comprehensive and simulates converting an index-file management system to a normalized database application. The students are given an Excel spreadsheet which contains data from the indexed-file system in a first normal form (FNF) format. The spreadsheet is imported into Access, and make-table queries are used to split the FNF table into third normal form (TNF) tables. The TNF tables must be modified to meet data specifications (data type, length, format, input masks, etc.) and documentation standards (captions and descriptions). Once primary and foreign keys are set, referential integrity constraints must be established between the TNF tables. The application specifications require development of queries, forms and a main switchboard. While other development aspects are covered in the class (reports, customized menus, etc.), they are not included in the evaluation due to time constraints.

As a preventative control, the students complete the evaluation assignment in a controlled environment. Specifically, the students are required to take the evaluation assignment in our computing laboratory, under supervision, within a specified time constraint. We make it very clear at the start of the evaluation that this is not a cooperative learning assignment. We also explicitly state, both verbally and in writing on the exam instructions, that e-mail and web activity may be monitored during the exam. Our institution does have privacy policies that prevent normal inspection of student e-mail and private file areas. When cheating is suspected, and other evidence suggests that electronic means were used in the cheating incident, we are able to obtain permission from the University's Legal Office to inspect those student accounts during the specific time period of the exam. We consider this "threat of detection" as a deterrent control (it is not a detective control by itself since other evidence of cheating must be provided before its use is authorized).

For a corrective control, we add complexity in a time-constrained environment. Each student is provided with a different data set, and multiple assignment formats are systematically assigned to the students (rather than randomly assign formats, we ensure that each member of a project team receives a different format). This discourages the exchange of formulas and methods via e-mail or other electronic means.

Our approach for detection is to provide each student with a unique, identifiable data set. These data sets are distributed just prior to the on-line evaluation. At the end of the designated time, the completed assignments are check for the unique identifier and matched to the student. We are also able to check the author and creation time properties of the submitted file. With this detection scheme, we can detect if students shared files, and can determine the specific individuals who colluded.

OBSERVATIONS

We are in our second year of using this control environment in the junior-year course. Prior to implementing this approach, we heard complaints from some students that some of their classmates were cheating on the electronic evaluation assignments. However, we were unable to verify the complaints of cheating since we did not have an effective detection scheme. Since implementing this approach, we believe that the incidence of cheating has dropped to a negligible level. We no longer hear complaints about cheating. In the first term that we applied these procedures in the junior-level course, we detected four cases of attempted cheating on the evaluation assignment (out of 90 students). In each of these instances, we were able to identify the individual who copied, and the individual who knowingly shared their solutions. All students were subjected to the appropriate disciplinary action, following the established institutional procedures. Although we did not publicize the cheating incidents that were detected, the word got out to other students that the detection approach was effective. Since then, there have been no detectable instances of cheating on the evaluation assignment.

Based on these observations, we conclude that the combination of controls is an effective deterrent for cheating during on-line examinations. Nonetheless, enterprising students will still find ways to cheat. For example, we did discover one instance where a student had multiple logins during the evaluation. Identifying who is logged into the system is a relatively easy task in most network environments, and we have now added this check as a control during our on-line exams. As with any control system, it is difficult to create manageable systems that cannot be defeated. Our goal has been to reduce the likelihood of cheating by reducing the opportunity to cheat. At this point, we believe that it takes more knowledge and effort to defeat the controls than to complete the evaluation assignment.

CONCLUSION

In this article, we have reviewed a number of the factors that may be associated with cheating and have provided a framework that may be used to address E-cheating. In our view, detection—along with subsequent enforcement of institutional policies and penalties—are critical components for the effective control of E-cheating in IS courses (as well as other courses). Many existing controls lack these two vital elements—resulting in the epidemic levels of cheating on campuses. The approach that we have developed to address E-cheating associated with our IS evaluation assignments appear to be working. We acknowledge that our controls are not 100 percent effective. However, our experience offers encouragement that there are ways to combat E-cheating in the IS classroom.

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PRE-TRAINING MOTIVATION TO LEARN: CONSTRUCT EXPLORATION FOR INFORMATION SYSTEMS TECHNOLOGY MEDIATED LEARNING

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ABSTRACT

Given the continued importance of training for information technology (IT) professionals, the ability to carefully manage training interventions is critical. One of the commonly recognized antecedents to successful training, trainee motivation to learn (Holton, 1996), appears to have had a limited conception in past IT research (Sein, Olfman and Bostrom, 1987; Venkatesh, 1999). While IT research has considered it to be a unidimensional construct, research in other domains indicates that it may possess multiple dimensions. This paper examines the dimensions of the motivation to learn construct in multiple domains, develops a training process research model that focuses on the motivation to learn construct, describes possible future research based on that model, and then provides implications for IT educators and trainers.

INTRODUCTION

Technology innovation is constantly and pervasively altering the way in which work is done. In order to maintain position or exceed current norms, information technology (IT) companies are constantly recalibrating competencies as new technologies and updates of existing technologies are released. To exploit and advance technologies, organizations must either retrain existing IT professionals or hire new IT professionals (Ryan, 1999). Given this environment, IT workers pursue their vocation under the auspice of innovation, which mandates continual learning.

Students aspiring to enter or advance their careers in the IT domain encounter a profession mandating lifelong learning. Learning may occur through various means including direct experience, vicarious experience, self-directed exploration of web or book content, and formal instruction through either educational institutions or training sources. In providing formal instruction to the intended audience, educational and training institutions may have to overcome the challenges of distance, efficiency, and access. Various forms and applications of technology have been introduced into the instructional environment to meet these and other challenges. Indeed, the use of instructional technology has boomed both in educational and training contexts (Alavi, 2001). The current landscape is such that IT learners will likely encounter formal instruction in a technology-mediated format in their pursuit of domain knowledge.

Unfortunately, even with best efforts and an extensive investment of resources, training and education is effective for some and not for others. Hence, it is no surprise that IT training frameworks integrate cognitive psychology, educational psychology, information science, and computer science. For example, a framework proposed by Bostrom "...indicates that the target system, training method, and individual differences, individually and in combination, affect a user's mental model to produce training outcomes, which include learning performance and attitudes toward using the target system on the job (Bostrom, Olfman, & Sein, 1990).

One means to enhance IT training effectiveness with respect to individual differences is to customize training to knowledge gaps (Gjestland, 2000). Another approach involves moderating trainee learning states (trainability) that may impede training effectiveness or alternatively, facilitating cognitive and attitudinal factors that enhance training effectiveness. A combined approach attempts to accommodate supportive trainee learning states as well as knowledge gaps through training customization. Skilled educators delivering traditional, stand-up instruction may use a combined approach as they develop lesson plans and deliver instruction to suit both perceived knowledge/skill gaps and the learning state of students.

Technology-mediated delivery mediums for learning introduce substantial challenge to delivering a combined approach that addresses knowledge/skill gaps as well as learner attitudes and cognitive states. How can we incorporate into computer based training programs what has often come from "intuition, common sense, and trial and error (Wlodkowski, 1985)? Nevertheless, in the quest to address issues associated with distance, efficiency, and access, technology-mediated learning (TML) may have to face this hurdle to enhance and improve (or even to replicate) traditional learning effectiveness. In a recent article, Alavi asserts not only a call for greater depth and breadth of research into technology-mediated learning, but highlight the void in research studies that "...focus on forming relationships among technology and relevant instructional, psychological, and environmental factors that will enhance learning outcomes (Alavi, 2001).

Trainability is hypothesized to be a function of three trainee factors: ability, motivation and perceptions of work environment (Noe & Schmitt, 1986; Waxley & Latham, 1981). Researchers have found a positive relationship between motivation and training outcomes (Baldwin, Magjuka, & Loher, 1991; Fracteau, Dobbins, Russell, Ladd, & Kudisch, 1995; Maier, 1973; Warr & Bunce, 1995). Vroom (1964) suggested that when motivation is low, both high and low ability individuals exhibited low levels of performance and when motivation is high, ability has a greater influence on performance. "Motivation is not only important because it is a necessary causal factor of learning, but because it mediates learning and is a consequence of learning as well (Wlodkowski, 1985). Unfortunately, the motivation construct brings with it a cornucopia of assumptions, terminology, and dimensions, particularly regarding adult learner motivation (Wlodkowski, 1985). A better understanding of the motivation to learn construct should facilitate interventions that can enhance positive training outcomes and return on investment (Baldwin, Magjuka and Loher, 1991; Fracteau, Dobbins, Russell, Ladd and Kudisch, 1995; Warr and Bunce, 1995). This paper proposes a research model that attempts to "specify the domain of the motivation to learn construct as one means of fortifying the foundation of IT technology-mediated learning research.

PRE-INSTRUCTION MOTIVATION

> Participants enter and leave training with varying levels of motivation that will likely influence how much they learn, whether they transfer learning to the job, and ultimately how successful the program is (Mathieu & Martineau, 1997).

Motivation is generally thought of as more of a state than a trait. As such, motivation is subject to malleability (Wlodkowski, 1985); it is possible that educators can positively affect a student's state of motivation to enhance the potential for effective training and education. Motivation measures can be used both pre- and post-training to assess the trainee's level of motivation (Kirkpatrick, Craig, & Bittel, 1996).

Students with a high pre-instruction motivation can be described as being "primed for learning, meaning they would be more attentive to learning training material and amenable to new ideas (Mathieu, Tannenbaum, & Salas, 1992). It is not surprising that most training studies recognize a high motivation to learn as an antecedent to learning and ultimately to training effectiveness (Baldwin et al., 1991; Goldstein, 1993; Holton, 1996; Mathieu & Martineau, 1997; Ryman, 1975; Sanders & Yanouzas, 1983; Tannenbaum, Mathieu, Salas, & Canon-Bowers, 1991). Correspondingly, researchers have found people with a low motivation to learn generally do not achieve desired training outcomes (Maier, 1973). Clark, Dobbins and Ladd (1993) assert, "...without motivation to learn, the most sophisticated training program cannot be effective.

Measuring pre-instruction motivation as a means for assessing customization needs may be a suitable and relevant initial step in customizing technology-mediated learning (TML) to student motivational needs. In traditional forms of instruction, the educator may employ obtrusive forms of motivation assessment in union with or independent of unobtrusive forms either before the instruction begins as part of the instructional design process or as part of opening the instructional process to determine an appropriate path for the instruction. An instructor or instructional designer may execute obtrusive forms of measurement such as a written or verbal survey to measure the student's motivational state. Little, if any, literature exists indicating obtrusive means of pre-training motivation to learn would compromise the instructional process. However, once the actual instructional process begins, it is doubtful the instructor would continue to use obtrusive forms of measurement as such measures may cause distraction and interrupt the flow of the instructional process. If an instructor had reason to reassess motivation once the instructional process began, they may more likely rely on unobtrusive measures, particularly observing student behaviors (Wlodkowski, 1985).

Incorporating appropriate obtrusive motivation to learn measures, such as validated survey instruments, into many TML mediums is well within the capacity of many existing technologies with minimal associated costs. Alternatively, using an instrument, apart from the TML medium (e.g. pen and paper or verbal) is possible. Measures of pre-instruction motivation may determine the appropriate customized "tone of the TML (such as the need for recurring positive feedback within the program) or even indicate the TML would not be appropriate given the learner's current motivational state. Mathieu, Tannenbaum and Salas (1992) contend trainees without pre-training motivation are unlikely to achieve learning objectives, even if they find the training program enjoyable. Hence, such a measure provides important information pertinent for customization direction even in the presence of an enjoyable TML session.

Conversely, though measures of motivation during the course of a TML session would provide valuable information in tandem with pre-training measures for adaptation purposes, unobtrusively acquiring such information may prove more difficult in the current environment and require a somewhat different set of measures. Measures of motivation during training may seek to assess the learner's current state of interest, enjoyment, and arousal in response to the stimulus of learning content and delivery style. Affective assessment software based on bio-sensory and/or physical appearance readings may provide welcomed promise as means to measure motivation without introducing an instrument that may disrupt the learning process. However, such technology seems to still be in development stages (Lisetti, Douglas, & LeRouge, 2001). Even in applying such tools to the TML context, a pre-training motivation assessment still holds as a critical first step in facilitating the learning process. By assessing pre-training motivation, stakeholders can diagnose if trainees are ready to accept training (Goldstein, 1993) and potentially introduce facilitating interventions in motivation deficient situations before the training process actually begins.

DeLone and McLean (2001) urge researchers to pay careful attention to context in defining and measuring each component of success included in their information systems success model and assessing inter-relationships between success constructs. Research also indicates that users prefer to tailor success constructs and measures to the type of system under evaluation to facilitate understanding and application (Jiang & Klein, 1999). Correspondingly, Alavi notes that the IS discipline itself "...may influence appropriate uses of TML (Alavi, 2001). Therefore, decomposition of a potentially multi-dimensional construct, like pre-instruction motivation, under the auspice of the domain characteristics and boundaries present in IT TML will provide a high degree of relevance and understanding to researchers and practitioners.

Decomposition of this construct provides researchers and practitioners with a connecting framework to facilitate TML success by considering the extent, nature, and appropriateness for various types of motivation interventions or customization in each situation of use.

Without an understanding of pre-instruction motivation in the IT TML environment, the potential for successful implementation of IT TML is diminished.

For researchers to study pre-instruction motivation in the context of IT technology-mediated learning, they must "specify the domain of the construct to the extent of exactness possible to define the conceptual content of the construct (Churchill, 1979). Without such study, it is questionable whether instruments applied or used would possess desirable psychometric properties and produce reliable results (Churchill, 1979). Though many studies and conceptual models position motivation to learn as an important construct in training and educational settings, comparing and synthesizing studies for potential transfer into the IT TML domain is difficult since the construct definition and dimensionality have varied across studies and have produced some mixed results (Baldwin et al., 1991; Mathieu et al., 1992; Noe & Schmitt, 1986).

The purpose of this study is to address that need by developing a research model for IT technology-mediated learning that encompasses the multiple dimensions of the motivation to learn construct that have been proposed by past research in various domains for testing in the IT TML domain. Future research based on this model will be proposed and implications for educators and trainers will be discussed.

RESEARCH MODEL

The fields of education, management, and psychology are the primary sources of prior research on the motivation to learn construct (Kanfer & Ackerman, 1989; Mathieu et al., 1992), although a limited body of work can also be found in the IS and instructional technology domains (Igbaria, Parasuraman, & Baroudi, 1996; Sein, 1987). Each domain has presented its own version of the motivation to learn construct; construct definitions from each domain are given in Table 1.

The construct's commonality between fields is that each field recognizes this motivation construct as a factor in training effectiveness. The various representations of the

TABLE 1
PRE-INSTRUCTION MOTIVATION CONSTRUCT AS REPRESENTED IN MULTIPLE DOMAINS

Literature Domain	*Construct Definition*
Education	"[T]he meaningfulness, value, and benefits of academic tasks to the learner regardless of whether or not they are intrinsically interesting (Marshall, 1987). Motivation to learn has also been characterized by long-term, quality involvement in learning and commitment to the process of learning (Ames, 1990).
Management	"[T]he extent to which trainees are stimulated to attend training, learn from training, and use the skills and/or knowledge obtained in training after returning to the job (Mathieu & Martineau, 1997).
Psychology	The "force that influences enthusiasm about the program (energizer); a stimulus that directs participants to learn and attempt to master the content of the program (director); and a force that influences the use of newly acquired knowledge and skills even in the presence of criticism and lack of reinforcement for use of the training content (maintenance) (Noe & Schmitt, 1986). Also, the proportion of the subject's total capacity devoted to the task (Kanfer & Ackerman, 1989).
Instructional Technology	Motivation to learn determines the magnitude and direction of learner behavior and is intertwined with the effectiveness of learner performance. Motivation to learn must be considered in all parts of an instructional message and is affected more profoundly by factors other than entertainment (Keller & Burkman, 1993).
Information Systems	Sein, Bostrom and Olfman (1987) associated motivation to the desire to use the technology skills conveyed in the training process. Venkatesh (1999) furthered this link to technology by tying perceived usefulness to the technology.

construct also seem to all suggest that the effects of pre-training motivation to learn seem to extend beyond the actual training experience to the ultimate objective, the transfer of skills acquired in training to the job context (Mathieu & Martineau, 1997). Representation of this theory can be found in the IT context; Ryan (1999) theorized pre-training motivation to be part of the learning process that may affect training effectiveness for the IT professional.

Domain perspectives vary in that researchers deviate in their attempts to explain motivation in "... terms of attitudes, beliefs, values, expectancies, attributions, needs, motives, deprivations and incentives, or reinforcements (Keller & Burkman, 1993). The disciplines also differ in the labels used to describe pre-instruction motivation. This incongruent representation presents a significant challenge to an in-depth understanding of this construct both in research and in practice.

Many studies present pre-instruction motivation as a uni-dimensional construct. However, the measures used and conceptualization of the construct among the various studies does not converge. Generally, past studies that examine pre-instruction motivation as a uni-dimensional construct only reported Cronbach's α as a means to validate internal validity for the measure (Mathieu et al., 1992; Noe & Schmitt, 1986). Though Cronbach's α is high in a number of these studies, Cronbach's α may provide incorrect results when the measure is multidimensional (Cronbach, 1951). This inaccuracy could plausibly lead to incorrect research conclusions.

This variation in definitions may suggest that pre-instruction motivation is a multi-dimensional construct. This has direct implications in the IT TML domain as it suggests that prescriptive interventions, such as TML customization, to address motivation deficiencies may vary according to the specific type of motivational deficiency. Some studies do investigate pre-instruction motivation as a multi-dimensional construct. The schema presented in Figure 1 is a decomposition of the dimensions of the pre-instruction motivation construct. This decomposition was derived through an informal meta-analysis of significant works (noted on Figure 1) indicating multi-dimensional aspects of motivation to learn. Just as the term for pre-training motivation is not exact in each supporting study, the labels associated with some underlying dimensions of intrinsic motivation may also vary and cause confusing overlaps. The model aggregates literature based upon the conceptual meaning of each construct conveyed in the study rather than upon the term used to label the construct. Discussion of the links and disjoins within this body of literature follow.

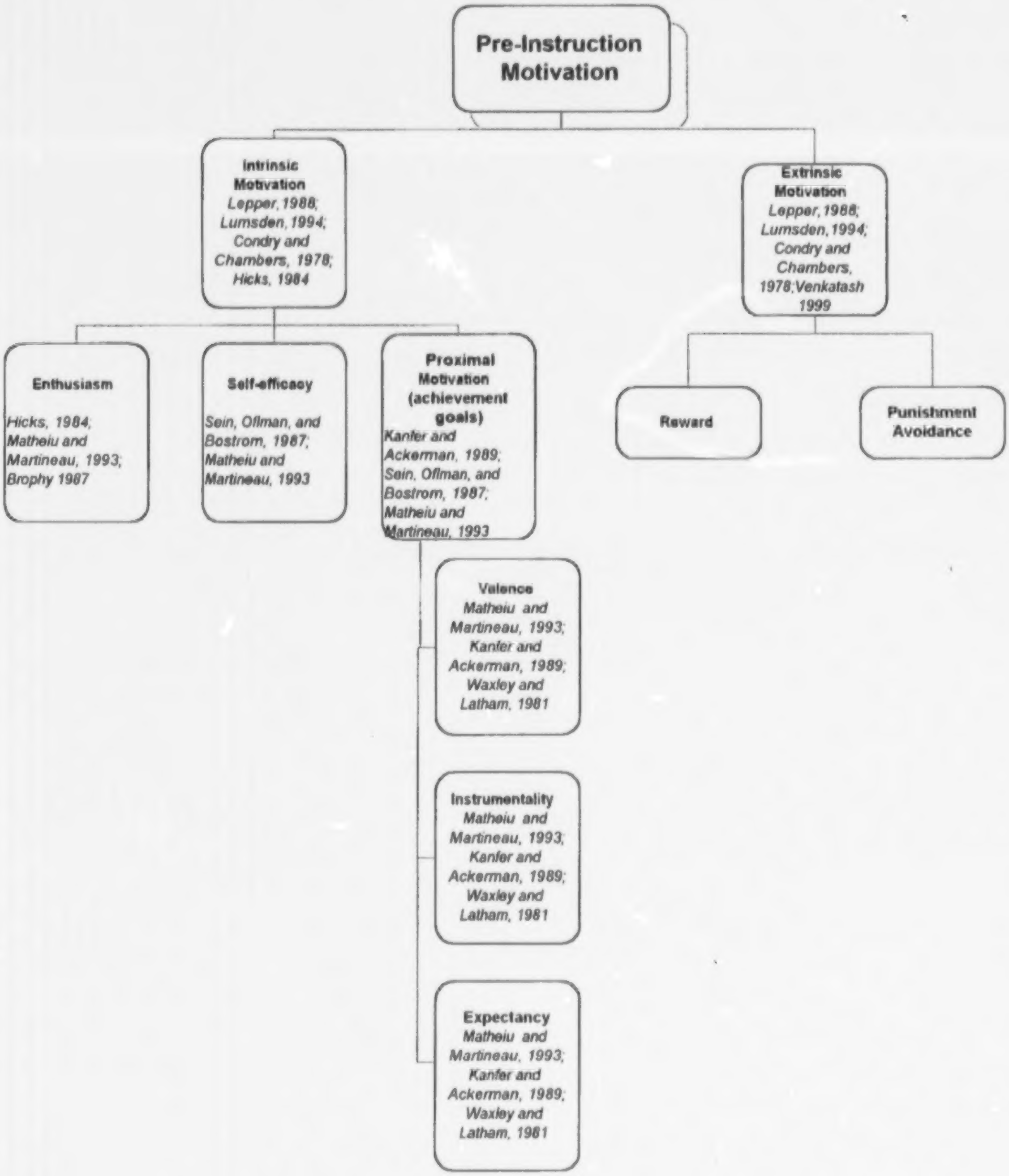
The proposed research model (Figure 1) first segregates pre-instruction motivation into intrinsic motivation and extrinsic motivation. Lepper (1988) called pre-instruction motivation "motivation to learn and presented motivation to learn as a multi-dimensional construct, encompassing both intrinsic motivation and extrinsic motivation. Extrinsic motivation is rooted in behavioral psychology; learner performance or participation is associated with attaining a reward or avoiding punishment that is external to the learning activity. However, rewards given without links to performance reduce interest (Bandura & Schunk, 1981). Extrinsic motivation does seem to reference the IT domain. For example, Venkatash (1999) labeled perceived technology usage as an outcome expectancy and, hence, a uni-dimensional measure of extrinsic motivation.

Though extrinsic motivation may have application relevance to the IT TML domain, the effectiveness of extrinsic reward structures on learning motivation is questionable (Ashton & Webb, 1986). Intrinsic motivation seems to have a stronger impact on instructional effectiveness.

Studies indicate that intrinsically motivated learners employ richer mental models, information gathering strategies, decision-making strategies, and information integration than learners who were externally motivated (Lepper, 1988; Lumsden, 1994; Condry & Chambers, 1978). Intrinsic motivation may have greater relevance in developing customized TML that seeks to enrich cognitive process by engaging the learner to undertake a learning task "for its own sake or to enhance self-efficacy according to that user's cognitive and affective state. A large body of research focuses on intrinsic motivation to learn.

The model presented in Figure 1 indicates that intrinsic motivation consists of the following dimensions: enthusiasm (motivation for instruction), self-efficacy, and proximal motivation (achievement goals). Though there are many studies that reference one or two of these dimensions, few studies have concurrently employed all three of these dimensions as separate and unique constructs in modeling motivation to learn. One exception is Matheiu and Martineau's (1997) conceptual work that claims that intrinsic motivation to learn is not

FIGURE 1
DIMENSIONALITY OF PRE-INSTRUCTION MOTIVATION


Pre-Instruction Motivation
Intrinsic Motivation
Lepper, 1988; Lumsden, 1994; Condry and Chambers, 1978; Hicks, 1984
Extrinsic Motivation
Lepper, 1988; Lumsden, 1994; Condry and Chambers, 1978; Venkatash 1999
Enthusiasm
Hicks, 1984; Matheiu and Martineau, 1993; Brophy 1987
Self-efficacy
Sein, Oflman, and Bostrom, 1987; Matheiu and Martineau, 1993
Proximal Motivation (achievement goals)
Kanfer and Ackerman, 1989; Sein, Oflman, and Bostrom, 1987; Matheiu and Martineau, 1993
Reward
Punishment Avoidance
Valence
Matheiu and Martineau, 1993; Kanfer and Ackerman, 1989; Waxley and Latham, 1981
Instrumentality
Matheiu and Martineau, 1993; Kanfer and Ackerman, 1989; Waxley and Latham, 1981
Expectancy
Matheiu and Martineau, 1993; Kanfer and Ackerman, 1989; Waxley and Latham, 1981

one, but three concepts: motivation for training (shown as enthusiasm/motivation for instruction in Figure 1), self-efficacy, and valence-instrumentality-expectancy (shown as dimensions of proximal motivation in Figure 1). However, neither Matheiu and Martineau (1997), nor other researchers seem to have operationalized all three dimensions in one empirical study.

In defining motivation for training, Matheiu and Martineau (1997) refer to the "extent that trainees are stimulated to attend training, learn from training and use the skills and/or knowledge obtained from training after returning to the job. Hicks recognized this same type of construct as one measure of intrinsic motivation to learn, but referred to this construct as trainee enthusiasm (Hicks, 1983). Brophy makes a distinction between intrinsic motivation (e.g. learning for the sake of learning) and motivation to learn (referring to positive affective aspects of motivation, like enjoyment or enthusiasm) stating that intrinsic motivation may exist without the presence of motivation to learn (Brophy, 1987). Brophy points out that intrinsic motivation (shown as self-efficacy and proximal motivation in Figure 1) may exist and induce performance where no motivation to learn exists (shown as enthusiasm in Figure 1) (Brophy, 1987). Conversely, motivation to learn can occur without enjoyment. Based on the foregoing discussion, it would appear that intrinsic motivation is composed of multiple dimensions, and that enthusiasm is just one of those dimensions.

Self-efficacy is another dimension of intrinsic motivation in the learning context. In adapting Bandura's definition of self-efficacy to a training context, self-efficacy can be thought of as a belief that one can master material with a reasonable amount of effort (Bandura, 1986). Studies examining learner self-efficacy indicate a positive relationship between self-efficacy and training performance and/or training reactions (Gist, Rosen, & Schwoerer, 1988; Gist, Schwoerer, & Rosen, 1989; Mathieu, Martineau, & Tannenbaum, 1993). However, these studies did not also examine enthusiasm and/or proximal motivation. In looking at motivation to learn within the IS domain, Sein, Olfman and Bostrom (1987) recognized self-efficacy as self-concept (trainee's view of ability to learn) and also recognized the application of goals in training through their discussion of the need for achievement and the desire to succeed at the learning task.

Achievement goals relate to proximal motivation. Certain properties of goals such as specificity, level, and proximity enhance motivation. Proximity references how far into the future individuals are able to project goals, and how closely sub-goals relate distal goals to current performance (Bandura & Schunk, 1981). Both of these dimensions affect self-motivational mechanisms. When learners can project the relationship between training and proximal goals or sub-goals, intrinsic motivation may be enhanced (Bandura & Schunk, 1981). In contrast, when instruction is associated with lofty distal goals, the large negative disparities between costs and benefits are likely to diminish intrinsic motivation (Bandura & Schunk, 1981). Kanfer reported that low-ability subjects benefit more from the imposition of a goal assignment declarative as part of the training than do high-ability subjects (Kanfer & Ackerman, 1989).

Researchers have used elements of Vroom's Expectancy theory (1964) as a theoretical underpinning for goal assignment (proximal motivation) by representing training performance as a joint function of cognitive ability and motivation (Kanfer & Ackerman, 1989; Waxley & Latham, 1981). To recognize expectancy theory as a theoretical underpinning of proximal motivation, instrumentality, valance and expectancy have been added to the pre-training motivation model as dimensions of proximal motivation. Valence refers to the degree of positive or negative value the individual associates with a given outcome, based on cognitive anticipations of affect regarding future outcomes. Instrumentality reflects the individual's assessment that a given performance level will lead to specific outcomes. Expectancy theory suggests that assuming a given level of ability and facilitating conditions, greater effort should lead to higher performance.

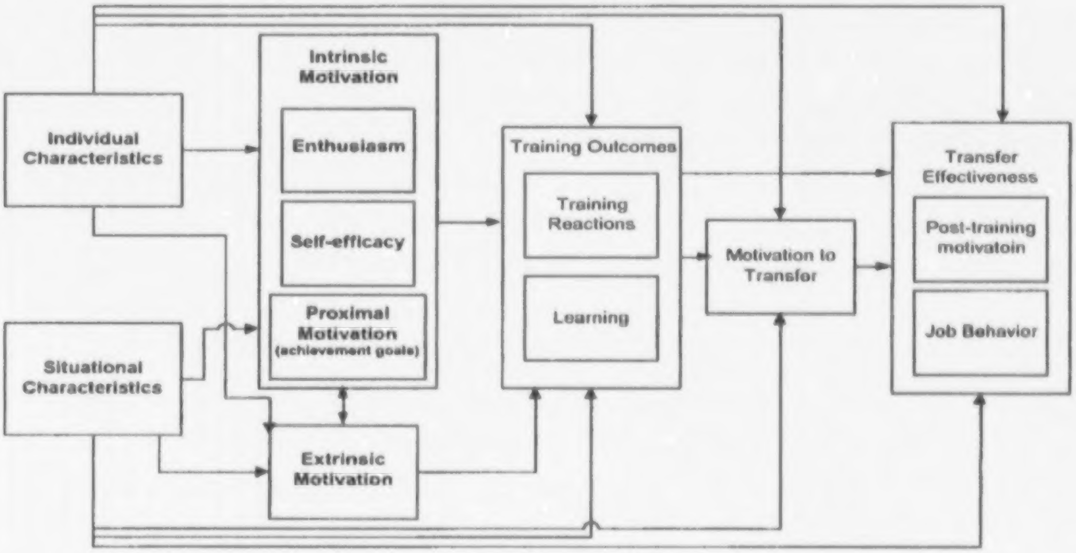
Though the focus of this study is specifically on the motivation to learn construct (highlighted in Figure 2), a more comprehensive training model that depicts other relationships suggested from past research provides perspective. Motivation to learn is shown to have an influence throughout the training process, as presented by Steers and Porter (1975) who viewed motivation to learn as having energizing, directing and maintaining components. To exemplify these components, an ideal training situation would include: an enthusiastic trainee or educator, a skilled and stimulating training facilitator (human or automated), and reinforcement and encouragement to apply newly acquired skills.

FUTURE WORK

The first step in testing whether intrinsic motivation to learn is a multi-dimensional construct as represented in the model would be to conduct survey research with measures for the various motivation to learn constructs. The data would be analyzed by an exploratory factor analysis followed by a confirmatory factor analysis using different subject pools. It seems relevant to assess intrinsic motivation to learn using quantitative means since 1) studies indicate that intrinsic motivation to learn may have the greatest effect on long lasting outcomes (Condry & Chambers, 1978; Lepper, 1988) and 2) intrinsic motivation to learn seems to be particularly vulnerable to multiple forms of representation in the literature. Measures of motivation to learn that have been frequently used in past training research will be adapted for this study (Colquitt & Simering, 1998; Fracteau et al., 1995; Mathieu & Martineau, 1997; Noe & Schmitt, 1986). Given that IT novices will have to undergo much training and education during the initial stages of their career, subjects will be chosen that appropriately represent IT novices.

Further research could explore the influence of the various dimensions of the motivation to learn construct on the process and outcomes of training and education. This would potentially provide practical prescriptions to compensate for low motivation situations, such as adjustments to training methods or learning processes that may find application in IT TML settings.

FIGURE 2
MOTIVATION TO LEARN –
MULTIDIMENSIONALITY AND KEY RELATIONSHIPS



Individual Characteristics
Situational Characteristics
Intrinsic Motivation
Enthusiasm
Self-efficacy
Proximal Motivation (achievement goals)
Extrinsic Motivation
Training Outcomes
Training Reactions
Learning
Motivation to Transfer
Transfer Effectiveness
Post-training motivatoin
Job Behavior

CONCLUSIONS

From a research perspective, a better understanding of the motivation to learn construct may enhance representation of this construct in IT TML research. If motivation to learn is a multi-dimensional construct, measures used in research should be appropriately developed to ensure internal validity. Hence, research should collectively and separately explore these dimensions to reach appropriate conclusions. Additionally, a more precise and richer understanding of this construct can facilitate insight into comprehensive training process models and provide direction for customizing TML to a learner's pre-training motivational state.

From a practical perspective, the skills required of IT professionals are constantly changing and competitive intellectual assets may affect market position creating a constant demand for IT training and formal education programs. Instructional sources are turning to TML to meet some of these demands and address the challenges of access, distance, and efficiency. The potential positive impact of effective IT training and education on businesses is substantial. Though significant investments in TML are being made (e-learning in the corporate sector alone is expected to grow to $14.5 billion revenue in 2004), TML is not a panacea and tends to ignore what is known about learning, such as the benefits of customizing instruction to meet learner needs and deficiencies (Munster, 2001).

Assessing pre-instruction motivation provides the opportunity to enhance the effectiveness of the learning experience (or mitigate the losses associated with an ineffective learning experience) by allowing stakeholders to respond proactively to the learner's motivational state. Pre-training measures of the dimensions of motivation may target the appropriate TML customization or other form of pre-training intervention best suited to the learner's motivation strengths and deficiencies. For example, if self-efficacy is found to be a significant dimension, educational studies indicate that a student in an environment that promotes self-worth, competence, and autonomy may more readily accept the risks inherent in learning. Hence, a TML environment that promotes enrichment and recurring positive feedback may enhance motivation to learn for a trainee with low efficacy.

To exemplify another condition, if an employee or student has a low proximal motivation measure, customization linking TML modules to career goals, interests, and [illegible] may help increase motivation to learn (Noe & Schmitt, 1986). Alternatively (or in addition to TML customization), the instructional source may choose to defer training until after the learner has received career guidance and mapping that associate training as a sub goal toward a specific distal or proximal goal. As an illustration, career workshops may provide students with a clearer picture of career paths and prerequisite skills for horizontal and vertical movement throughout an organization. Such interventions may stimulate students' exploratory behavior and motivation to learn (Noe & Schmitt, 1986), which may facilitate the benefit of TML.

A better understanding of the motivation to learn construct may provide trainers and educators with the clarity required to more effectively and directly respond to challenges regarding motivation to learn issues with trainees and IT students. Targeting prescriptive practices to specific dimensions of the motivation to learn construct can potentially lead to a better return on training investments, an expansion of learning options, and increased satisfaction with the learning process.

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A FINANCE APPLICATION OF INFORMATION TECHNOLOGY

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ABSTRACT

The Internet is a valuable tool in area of Finance. Since its inception, it has become a major source of information to the discipline. This paper is a description of a project at a college where financial concepts are combined with a research component using the internet. Furthermore, an information management function is incorporated into the project. Another part of the paper deals with the feedback on the project. Some the information available to the researchers is discussed and critiqued. Teamwork is another application used in this project. Overall, this project is deemed a success in that students had an opportunity to analyze real life scenarios.

INTRODUCTION

The impact of the Internet on the finance curriculum has been enormous. The purpose of this paper is to discuss the use of the Internet for a project in the Finance classroom. In addition, it will describe the information found on these sites.

Web sites such as Yahoo.com and CNBC.com have had a tremendous impact in the Finance. It is now possible to get quotes and even trade stocks over the Internet. Furthermore, many companies have web sites that provide annual report information. Some sites, like Wendy's International, have it so that one may can download the information as a spreadsheet.

In an increasingly technology-dependent economy, all students, not just finance students, need to be adept with Internet technologies. Students must know about search engines, how to structure search queries, and how to maneuver through cyberspace. They must know how to follow links and download information. A basic knowledge of spreadsheets is also imperative to the success of each individual.

One of the concerns of the professor involved is the simplicity of financial statements in textbooks. The professor believes real life examples would make for a better educational experience for the students. Consequently, this project was developed.

Since businesses and the economy move quickly, the use of the most current data and the ability to rapidly analyze it is crucial to the business professional. One of the goals of the project is for students to identify potential sources of information to solve business problems and show how the internet can be used for that purpose.

PREVIOUS RESEARCH

No research specifically has been done on student projects such as this. However, Matsumoto and other surveyed professional financial analysts. They identified 32 ratios that these professionals considered to be important in the analysis of companies. This study used some of these ratios as 13 are incorporated into the study.

Two other studies identified financial uses of the internet. One offered a guide to how to do a search and the other identified some possible sources of information.

PROJECT

This project has evolved over the years. Initially, the students did these projects solo. However, a problem existed in that current industry averages were not currently available. Furthermore, Business Advisory Boards recommend group work since they expect their employees to work in groups to solve problems. Therefore, the use of groups was initiated in 1999. Teamwork provides for active learning opportunities to occur.

The course used for this study is the basic financial management course taught at the undergraduate level. Part of the course involves a project where the students have to do financial research on publicly traded companies. Students are paired in a group of two or three. Furthermore, students are allowed to select their teammates and companies. Each group picks a company per each student. The companies for each group must be competitors of one another. For example, Exxon and Texaco would be good selections if the students are interested in energy companies. These companies must be publicly traded on an exchange so that the information is readily available. Companies must be approved in advance by the professor since banks and other financial institutions have alternative forms of financial statements in terms of presentation. Once a company was chosen, another team in the same section of the course could not use that company.

The next step is for the students to obtain the necessary financial statements. Computations required are two liquidity ratios, current and quick. Liquidity ratios measure a company's ability pay its bills. Activity ratios include inventory turnover, day's sales outstanding, and fixed asset turnover. Activity ratios measure how well the assets of the company are being managed. Leverage ratios include historical debt ratio, times interest ratio, and market based debt ratio. These ratios measure the use of debt by the company. Profitability ratios are gross profit margin, operating profit margin, net profit margin, return on assets, and return on equity. These ratios look at the overall of the company in relation to the income earned. All required ratios are discussed at length in class. Three years of ratios are required to look at a possible trend. Three years of data is required. It provides for some research opportunities since most annual reports include only two years worth of balance sheets.

After computations are made for their company, the students are required to compare these ratios between companies. For example, the liquidity of one company is compared to the liquidity of the competitor. Furthermore, they are to analyze any trends that exist in the data. Next, they have to decide whether they would invest in these companies. Another decision to be made is whether to loan these companies money. Defense for their decisions must be based on the above information or any other relevant information.

SOME OBSERVATIONS

A survey was taken to determine where the students obtained their financial statements. With the exception of EDGAR and the other category, the faculty member showed how to navigate these web sites. The sources of information is as follows.

TABLE 1
SOURCES OF FINANCIAL INFORMATION

Source	Percent
Yahoo	50%
Company web page	35%
CNBC	12%
EDGAR	6%
Other	7%

One observation related to the Yahoo web site is that sometimes it did not have the desired information in the research link. The information needed could be found on another link. EDGAR is not too user friendly since you have to scroll down to find the appropriate information needed. Some web sites were found to less than user-friendly. For example, some companies did not provide their financials or were hard to locate. The fact that some companies did not have financial information available on their website was surprising since websites have become an important source of information for investors. Some had data files that were downloadable in a spreadsheet format. Adobe Acrobat is the most popular medium on the website for presenting the financial information. The breakdown is as follows.

TABLE 2
SUMMARY OF FINANCIAL INFORMATION AVAILABLE FROM COMPANY'S WEBSITE

Format	Percent
Adobe	34%
No financial information available	26%
HTML	22%
Excel	9%
Edgar	9%

One of the major goals of the project is that students get to work with real life scenarios. Some students commented as to learning more about companies in working with them on the projects. It also exposed the student to financial statements that had anomalies that they had not been exposed to before. Unless they are accounting majors, assets such as goodwill, capitalized research and development, deferred income taxes are accounts that students have not been exposed to.

Other non-quantitative observations are that some students were not good team members. They did not perform up to their team member's expectations. This is an occurrence when group work is used. As mentioned earlier, it represents an opportunity for active learning to occur. A related issue at this school is the honor code in place. The wording of the honor code does not encourage group work by students. The professor, at times, had to encourage the students work together. At the present time, firing of team members for non-performance is not allowed. In the future, that may be allowed.

FEEDBACK BY STUDENTS

The following are comments from student evaluations of the course made by students for the last three years.

1998

1. Stock market project needs to be more specific or thrown out.
2. I enjoyed how to read how well a corporation is doing by its ratios.
3. Students need more explanation of expectations for paper.
4. Financial analysis

1999

1. I thoroughly enjoyed the project. It helped me to better understand the significance of financial ratios.
2. In terms of the group project, that was not helpful to me and it was "busy work."
3. Learned things that could help me in the future about stocks and bonds.

2000

1. Helps me to understand other Business and Accounting Courses.
2. Having the project due early in the semester was extremely appreciated.
3. Interpreting financial ratios and statements.
4. He was able to explain things well on the group projects.
5. All aspects, it provided a good understanding of the principals of finance which is helpful at my job and evaluating company's as investments.
6. The project was interesting and showed how to apply the findings to determine the company's strengths.
7. The way we applied the information learned in class to real life companies was very valuable. That aspect helped in realizing the importance of finance to organizations.
8. Practical application project.
9. The ratio project tremendously helped my grade.
10. I found the project to be especially helpful because it allowed me to see how different companies compare and how the ratios are used to judge the financial stability of businesses.
11. Analysis of financial statements. I feel I am better at understanding a company's financial statement and its standing compared to similar companies.
12. I think the use of actual companies for our examples in class and our projects was helpful in making us realize how what we are learning is used.

13. I found the aspects of the course that dealt with stocks and realistic issues to be the most helpful.

It is interesting that all of the comments from 2000 were positive. Many more comments were made about the project in 2000.

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APPENDIX A
LIST OF RATIOS COMPUTED

- Current Ratio
- Quick Ratio
- Average Collection Period
  (Day's Sales Outstanding)
- Inventory Turnover
- Fixed Asset Turnover
- Total Asset Turnover
- Debt Ratio
- Times Interest Earned
- A Market Based Debt Ratio
- Gross Profit Margin
- Operating Profit Margin
- Net Profit Margin
- Return on Equity

APPENDIX B
LIST OF COMPANIES USED BY STUDENTS

- Adidas
- Alltel
- Anheuser-Busch
- Cisco
- Compaq
- Coors
- Direct TV
- Ford
- Fuji
- Gap
- Gateway
- General Motors
- The Home Depot
- Kmart
- Kodak
- The Limited
- Lowe's
- Lucent Technologies
- Nike
- Nortel
- Papa John's
- Pizza Inn
- Reebok
- Sciquest
- Southwest Airlines
- Sprint
- Target
- Time Warner
- USAirways
- Ventro
- Wal-Mart

TUTORIAL FOR A FRAMEWORK TO INTRODUCE THE EXTENSIBLE MARKUP LANGUAGE (XML) INTO INFORMATION SYSTEMS COURSEWORK

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ABSTRACT

New methods are required to efficiently and effectively handle the storage, retrieval, presentation and exchange of the vast amount of information electronically available. The eXtensible Markup Language (XML) was introduced to extend the capabilities of Web technologies to include a standardized way to exchange data. Consequently, the implications of XML permeate not only technology issues but also inter-business communications and industry standards in regards to data exchange. While interest in XML is high, the newness of the technology means there are few resources available for introducing XML into the IS classroom. This paper presents an introduction to XML and a short tutorial focused on basic XML vocabulary and elementary principles related to the creation of XML documents and associated DTD and schema technologies. Finally, A scenario is presented that can be used as a classroom exercise to provide students with the opportunity to explore the considerations and challenges of deploying XML technologies.

INTRODUCTION

As computing technologies expand, so does the collection of data. New methods are required to efficiently and effectively handle the storage, retrieval, presentation and exchange of the vast amount of information electronically available. SGML (Standardized Markup Language) was introduced more then twenty years ago to provide a framework for device independent representation of text in electronic form. An outgrowth of this framework was HTML (HyperText Markup Language). HTML provides an easy to use and standardized way to present multimedia information over the World Wide Web. The same international standardization body, the World Wide Web Consortium, known as W3C, that oversees the development of SGML and HTML introduced XML (eXtensible Markup Language) in 1996. The objective of the WC3 was to extend the capabilities of current Web-based technologies. XML is poised to be the next Internet standard for computer-to-computer exchange of data (Herman, 2001). XML has captured the attention of the business marketplace and research firms are touting it as the "Next Big Thing." The percentage of businesses planning on implementing some aspects of XML in 2001 is expected to rise from a current 20% to 78%. E-commerce transactions using XML are predicted to rise to over 40% by the end of 2003 (Patrizio, 2001). While interest in XML is high, the newness of the technology means there are very few resource materials available for introducing XML into the IS classroom. XML is multi-faceted; it is not another programming language. The implications of XML permeate not only technology issues but also inter-business communications and industry standards in regards to data exchange. This tutorial will provide a framework for introducing XML into an information systems class and will include an exploration of XML and its corresponding components, technical implementation requirements, the development of Document Type Definitions (DTDs) or schemas for defining industry standard data definitions and the potential impact of XML on the field of information systems.

Background Information on XML and Its Potential Importance

XML is a meta-standard for defining other markup languages. Herman (2001) summarized what this means, "By itself XML does not provide any specific data standards. Instead, XML provides a standardized language for creating such standards. That's why XML is called 'extensible;' it will be used by others to develop industry-or function-specific data definitions" (p. 27). The premise behind XML is that is separates data from presentation. With XML, systems can exchange structured data, interpret that data, and display the data in any number of different ways. An XML stylesheet tells a Web browser exactly how to display the data in an XML document and an XML Document Type Definition or schema stores the definitions of tags related to industry specific data or fields of knowledge. Document Type Definitions (DTDs) or schemas, often referred to as dictionaries or vocabularies, serve as a uniform source of data definitions to promote the exchange of information between organizations within the same industry.

The uses for XML are many. XML promises to be a neutral method for exchanging data between two systems or applications (Patrizio, 2001). The first major area of interest in XML resides within the business community. E-business is rapidly evolving due to the advances in technology that are continually underway; XML is intended to be a primary facilitator of the exchange of data between businesses involved in commerce such as B2B exchanges, consolidated supply chain methods for suppliers and vendors, and ease of Web site development for B2C companies. The current heterogeneous technology landscape characterized by multiple platforms employing various operating systems, database systems and software developed in multiple languages makes it difficult to facilitate the exchange of data between such systems. XML provides a common solution replacing the need for developing customized interfaces. The use of XML for databases is another large initiative. Databases are used in business, academics, search engine operations, and in virtually every other area of technology. XML can make the updating of data within databases considerably simpler by virtue of its design. XML makes use of object-oriented programming principles that allow for data templates to be created replacing the need to specify individual data items. XML also will be the basis for enterprise application integration (EAI) middleware (Herman, 2001), which will tie applications together across heterogeneous platforms including linking legacy systems to newer Internet based systems. Finally, XML will also "be key to handling the proliferation of new kinds of devices. Once data is encoded in XML, it can be combined with multiple stylesheets for formatting in different kinds of devices—from a PC to a PDA or Webphone. More radical transformations of the data also will be possible, such as from a text to a speech interface" (Herman, 2001).

Challenges of XML

XML is not without limitations and pitfalls. Those with technical backgrounds can draw on previously acquired skills to learn XML, but the learning curve nonetheless is steep. The technologies associated with XML are also far from complete. One major limitation is the lack of support from browser technologies. Both Microsoft and Netscape's current browsers do not readily support XML at the level needed for easy application development or viewing. While XML assists in interoperability of data and applications, the development of different standards and DTDs and schemas by all types of industries and organizations is rapidly leading to confusion and a general lack of standards agreement. Kiely (1999) contends that XML's flexibility can also be a downfall as "...it's so flexible that two uncoordinated efforts to design schemas using XML produce incompatible results." As often happens with the introduction of a new technology, misperceptions and hype about its capabilities abound. Clay Shirky (2000), summed up this up best when he described XML as a 'Magic Problem Solver.' According to Mr. Shirky, a "...Magic Problem Solver is technology that non-technologists believe can dissolve stubborn problems on contact" (Shirky, 2000).

A primary benefit, and yet a major challenge for XML, will be related to interoperability. XML will facilitate the exchange of data but it will not happen as quickly as predicted. Shirky (2000) describes the "three sad truths" associated with XML. First, XML cannot design itself. People will still have to figure out how best to represent their data, and then design tags that mark it up in the best way. Second, XML is not without pain. Implementing XML is time-consuming, costly, and often extremely complicated, especially when outdated legacy systems are involved. Finally, the politics involved in creating new standards and designing interoperable systems has nothing to do with the technology—it's all about money and power. Everyone wants to control the latest, greatest thing, and when too many forces act on something in a plethora of different directions, it goes nowhere (p. 75).

Even given these shortcomings, XML is positioned to thrive in the electronic marketplace as it facilitates intercommunications between businesses. Further, XML has the support of the major technology companies.One of the main premises behind Microsoft's new .Net strategy is the belief that XML marks a turning point in the evolution of the Internet and computing architectures (Herman, 2001). While most expect that it will take a few years for XML to transcend the technology landscape, it is moving ahead at a rapid pace and will continue to mature into a key technology in the field of information systems.

As XML is a new technology, few course materials are available to guide faculty in the introduction of this pervasive technology into existing IS courses. XML skill books that train students on the mechanics of XML coding are appearing on the market in mass. While the importance of acquiring an XML coding skill set should not be diminished, developing an understanding of the implications of XML as a technology that will transcend the development, implementation and use of information systems and transform business processes is paramount for the IS student. Facilitating the exchange of data and developing applications that incorporate dynamic presentation capabilities can be explained on a technical level in a straightforward manner. Understanding how these technicalities might be adopted and used is more complex. It requires an assessment of technologies and business processes, their interactions with each other and with the people who define them. XML further compounds the complexities of the people-process-technology triad by extending its reach beyond the internal organization to external entities who may even be competitors within the same industry.It will be imperative for students in the field of information systems to develop a knowledge base related to XML, its capabilities, limitations, implementation and use.

XML TUTORIAL

The rest of this paper will be a short tutorial of the elementary principles for creating XML documents and corresponding resource files for DTDs and schemas. The tutorial will begin with an introduction to the basic vocabulary of XML and will end with a short scenario employing XML to exchange data between two computer systems. This tutorial can be used to present XML concepts in information systems or e-business courses that cover new technologies or issues related to systems integration and the sharing of data between software applications, or exchanging data between disparate database systems.

XML Structure and Vocabulary

In order to assess the potential impact of XML, it is necessary to understand the basic principles of XML. XML is multi-faceted and incorporates an expansive array of resources. XML is used to create 'self-describing documents' or a document that includes information describing what the document contains. As XML is a markup language, the 'describing information' is placed within tags. The advantages to this are numerous. First, XML is not limited to a fixed set of element types, or tags. For example, if XML is to be used to tag a document that describes a recipe, tags may be chosen to represent each ingredient as an *item*, or as an *ingredient*, or as *groceries* – the decision is made based on the project and preference of the developer.

XML is more flexible than other commonly used markup languages such as HTML, the language used for Web pages. Consequently, HTML files look similar to XML files. However, the focus of HTML documents is to define how information is presented while the tags defined in XML documents describe the data and rely upon other technologies to handle the presentation of that data. This is advantageous when information is intended to be displayed in more than one manner. Once a tag has been used to define data within an XML document, the data can be used in a variety of ways. For instance, selected data from an XML document can be combined with data from another application or database and the combined data can then be presented back to the user. Search engines also provide better results on XML documents since the tags are descriptive of the actual data.

Further, XML documents are simply plain text files. This has many advantages. XML documents are easily readable both by people, programming languages and other applications. In addition, XML files are easily transferred across a network and can be passed using HTTP, the transport protocol of the Internet.

XML technologies are structured around a collection of documents (files) and other associated resources. At the core, is the XML document. An XML document contains tags, elements and corresponding data or content. Associated with this XML document will be other files such as DTDs or schemas that specify what elements a document can contain or eXtensible Stylesheet Language (XSL) documents that describe how the data is to be displayed. These types of files do not contain data per se, but contain definitions or descriptions of how the data in the XML document should be handled.Other associated resources include Application Programming Interfaces (APIs) that allow programmers to make calls or interface with the XML document as it is being processed.

The foremost rule of XML is that it must be well-formed.A well-formed document is one that is properly formatted and follows the basic rules of XML programming. One of the primary reasons that the language is extensible is that its rules are rigid. In order to use XML programs in many different ways, all of the programs must follow the same rules. Other markup languages do not require such standards, and thus tend to be restricted to one initial purpose or project. For example, most HTML documents tend to merge describing the data with describing the layout or format of the data. If these two ideas are interwoven, then the data can only be used for that purpose – it cannot be presented in another layout without editing the code. While the strict requirements of XML are sometimes seen as a disadvantage, well-formedness supports the core XML advantage of extensibility.

Several initiatives are underway to develop standard specifications or vocabularies for applying XML to a variety of technologies. These efforts include incorporating XML with relational databases, using XML to define large documents and using XML to facilitate the exchange and presentation of discipline specific data. For instance, XML applications include the Chemical Markup Language for managing chemical data, the Mathematical Markup Language for Mathematical equations, MusicML for sheet music, Voice XML for the spoken work and ebXML which is a set of specifications designed to facilitate the exchange of business transactions over the Internet.

While the resources associated with XML are many, a word of caution should be noted. XML is a young technology and many facets are still evolving and have not yet reach a standardized form. This presents many challenges to the XML developer. One goal of XML is to use the XML document as the foundation for data exchange and data presentation. XML as a medium for the exchange of data is operational. DTDs specifications were approved with the original XML specification. However, schemas, which are quickly becoming the preferred choice for data definitions, only reached approval in May of 2001. Data presentation is much more challenging. Current browsers do not fully support XML and it will be a while before these technologies converge. XSL, the style language for rendering presentation of XML data, is a proposed recommendation meaning that it is still under development and review. Until XSL matures to an accepted recommendation by the W3C, it will not be widely implemented.

XML standards and technologies encompass their own vocabulary of terms and acronyms. Just as with learning any language, learning XML requires developing a basic understanding of its structure and familiarity with its primary lexicon. Following is a list of common XML terms and their associated meanings.

Basic XML Vocabulary and Terms

XML document – The XML document is the primary component of XML. The XML document contains elements, data or content and processing instructions.

XML parser – An XML parser reads an XML document and verifies that its contents are well-formed. The parser will identify any error found but will not attempt to fix them. Browsers such as Microsoft's Internet Explorer include an XML parser (but it does not check for validity.) In addition, several XML parsers have been written. Parsers are included with commercial XML development environments, included with books on XML or can be found on the Internet. Many are free such as Apache XML Project's Xerces-J available at http://xml.apache.org/xerces-j/.

Document Type Definition (DTD) – A Document Type Definition specifies a set of rules that defines or constrains the contents of an XML document. Basically, the DTD is a coded list that identifies what tags in the XML document describe data and what constraints are put on that data. DTDs provide a common data definition and can be shared among many XML documents regardless of their location.

Schema – The schema performs the same function as the DTD and is expected to be a replacement for the DTD. One primary difference between the two is that schemas are written in XML where DTDs have their own syntax. Another advantage is that the schema supports datatypes unlike the DTD that only supports strings. This requires a receiving application to convert the data to a different data type, such as a number, if necessary. The power of schemas is that they also can be shared by many different XML documents. Several initiatives are underway to develop industry specific schemas to facilitate the exchange of data between different organizations.

Well-formedness – XML is a highly structured language and XML parsers make no attempts to fix any errors found within an XML document. Consequently, for XML documents to be usable, they must be well-formed. Well-formedness means that the XML documents adheres to the rules of XML. XML rules are defined in the XML Specification (World Wide Web Consortium, 2000).

Valid XML document – DTDs and schemas contain data specifications. XML documents are compared against their corresponding DTD or schema in a process known as validation. A document must meet specific criteria in order to be valid. It must be well-formed, it must have a corresponding DTD or schema and it must meet all the constraints listed in the DTD or schema. Not all XML documents have a corresponding DTD or schema so will not need to be checked for validity and not all XML parsers check for validity.

eXtensible Stylesheet Language (XSL) and XSL Transformation (XSLT) – XML separates data from its presentation. The XML technology used to render or present data contained in an XML document is the eXtensible Stylesheet Language (XSL). XSL contains a set of rules that are used to build templates that specify how XML document data are to be formatted for display. XSL is still under development. Consequently, no browser currently in use fully supports XSL. The current approach is to use an XSLT processor to transform XSL stylesheets into HTML output.

Cascading StyleSheets (CSS) – Cascading StyleSheets provide another method for applying style to display data contained in XML documents. XSL provides more functionality than CSS but is harder to learn. CSS specifications were originally developed to work with HTML files but because of backward compatibility, CSS has not been widely implemented. As with XSL, not all browsers support Cascading StyleSheets.

Xlink and XPointer – Xlink and Xpointer are evolving XML technologies that extend the use of linking documents or parts of documents together. Xlinks point to documents and Xpointers to individual parts of a document. The most common types of links used today are HTML link tags which link one HTML document to another. Currently these links are uni-directional pointing to a particular document at a particular location. Xlink supports multi-directional links and Xpointer allows links to individual parts of a document.

XML APIs – XML documents themselves do not do anything. In order for them to be truly useful, data contained in these documents must be accessible by other applications. The software capable of reading XML documents and providing access to its content are XML Application Programming Interfaces (APIs). Developers can write their own APIs or use industry standard APIs. The two most common are the Document Object Model (DOM) and the Simple API for XML (SAX).

Document Object Model (DOM) – The DOM provides a means for standardized access to XML documents. The DOM itself is not a program but a specification that implements a set of APIs that define how DOM compliant software can interface to XML documents. The DOM resides between the XML parser and the application requesting information from the XML document. The parser reads data from the XML document and feeds it into the DOM which is then accessed by the application. This method works by reading the entire document into memory and constructing a tree of its contents. The major disadvantage to the DOM is its extensive use of memory.

Simple API for XML (SAX) – SAX is an alternative to the DOM, but not necessarily a replacement. Like the DOM, SAX provides an interface between the XML parser and an application. SAX is event driven. Rather than storing the XML document in memory, SAX streams the document from start to finish looking for events that require action. SAX does not require the memory resources DOM does. However, for complex implementations, SAX may require several parses of the XML document.

CREATING AN XML DOCUMENT

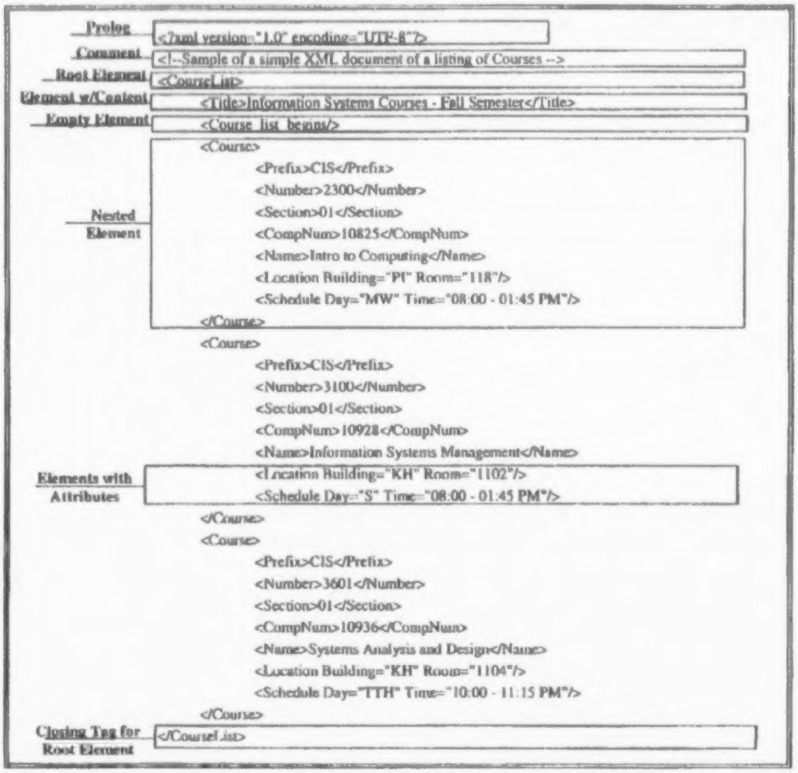
XML is a markup language. A markup language is a set of rules and XML is a highly structured markup language meaning it requires its users to follow the rules explicitly. The basic components of a markup language are tags and elements. Tags are labels delimited by angle brackets while elements refer to tags plus their content. The basic rule of XML is that all elements must be surrounded by a beginning tag and an ending tag. Beginning tags are identified with the '<' and '>' symbols while ending tags are identified with '</' and '>'.

Beginning tag: <TITLE>
Ending tag: </TITLE>
Element: <TITLE> XML Tutorial </TITLE>

An XML document is plain text and may be created in any text editor including Notepad which comes with Windows operating systems. XML documents are identified by a three-character filename extension of .xml.

The basic building blocks of XML are elements and attributes. A complex XML document contains other components as well but this tutorial will be limited to the elementary principles of creating a simple XML document. Figure 1 provides an example of a simple XML document followed by detailed explanations of the annotations.

FIGURE 1
SAMPLE OF A SIMPLE XML DOCUMENT



```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample of a simple XML document of a listing of Courses -->
<CourseList>
        <Title>Information Systems Courses - Fall Semester</Title>
        <Course_list_begins/>
        <Course>
                <Prefix>CIS</Prefix>
                <Number>2300</Number>
                <Section>01</Section>
                <CompNum>10825</CompNum>
                <Name>Intro to Computing</Name>
                <Location Building="PI" Room="118"/>
                <Schedule Day="MW" Time="08:00 - 01:45 PM"/>
        </Course>
        <Course>
                <Prefix>CIS</Prefix>
                <Number>3100</Number>
                <Section>01</Section>
                <CompNum>10928</CompNum>
                <Name>Information Systems Management</Name>
                <Location Building="KH" Room="1102"/>
                <Schedule Day="S" Time="08:00 - 01:45 PM"/>
        </Course>
        <Course>
                <Prefix>CIS</Prefix>
                <Number>3601</Number>
                <Section>01</Section>
                <CompNum>10936</CompNum>
                <Name>Systems Analysis and Design</Name>
                <Location Building="KH" Room="1104"/>
                <Schedule Day="TTH" Time="10:00 - 11:15 PM"/>
        </Course>
</CourseList>
```

Description of the XML Document Components

Prolog – The prolog contains the XML Declaration which is always the first line of any XML file. There should be nothing, including white space, before the declaration. The XML Declaration tells the processor which version of XML to use. A simple declaration may be: <?xml version = “1.0”>. A complex declaration may include more information, such as: <?xml version = “1.0” encoding = “UTF-8” standalone = “yes”?>.”1.0” describes the version of XML being utilized (currently there is only one version of XML); “UTF-8” describes the language encoding such as English ASCII; and “yes” or “no” indicates whether or not the document relies on markup declarations defined external to the document.

Comment – Comments may be included in XML files. They are ignored by the parser. Comments are included between the tags “<–” and “-->”.

Root Element – The most important component of the XML document is the element. All XML documents must have at least one element. The first element is known as the root element (also may be referred to as the document element) under which all other elements are nested. In Figure 1, the root element is ‘CourseList.’

Element with Content – The most common format for elements is: <start-tag> content </end-tag>. This format is used for the majority of elements in Figure 1.

Empty Element – Elements with no content are known as empty elements. Empty elements are used when only the presence of the element is needed or the element contains only attributes.

Nested Elements – Elements may contain other elements. This is referred to as nesting elements. In Figure 1, the Course element contains several other elements such as Prefix, Number, etc. In fact, the basic structure of XML documents is based on nesting all elements within the root element. The improper nesting of elements is one of the most common mistakes made when developing XML documents. If an element starts within another ele-ment, it must also end within that element. Table 1 shows the difference between incorrect and correct placement of end tags.

TABLE 1
EXAMPLE OF INCORRECTLY AND CORRECTLY NESTED ELEMENTS

Correctly Nested Elements	Incorrectly Nested Elements
<Course> <Prefix>CIS </Prefix> </Course>	<Course> <Prefix>CIS </Course> </Prefix>
	**The end tag for the Prefix element must come before the end tag for the Course element*

Elements with Attributes – Attributes are included in the beginning tag of an element and follow the format attribute = value. The value must always be enclosed in single or double quotes. An element may contain several attributes such as in Figure 1 where the element Location contains two attributes, Building and Room and the element Schedule contains the attributes Day and Time. The decision to use an attribute or element is a matter of preference. A general rule, however, is to use an element for content that needs to be extracted individually and attributes for content not independently relevant. For instance the attributes Building and Room are not independently relevant but are directly related to the course Location.

Closing Tag for Root Element – Generally the last line of an XML document is the closing tag for the root element.

Well-Formedness of the XML document – Upon becoming familiar with the language, but prior to constructing an XML document, the rules for a well-formed document should be understood.

- The XML Declaration must appear at the beginning of the document.

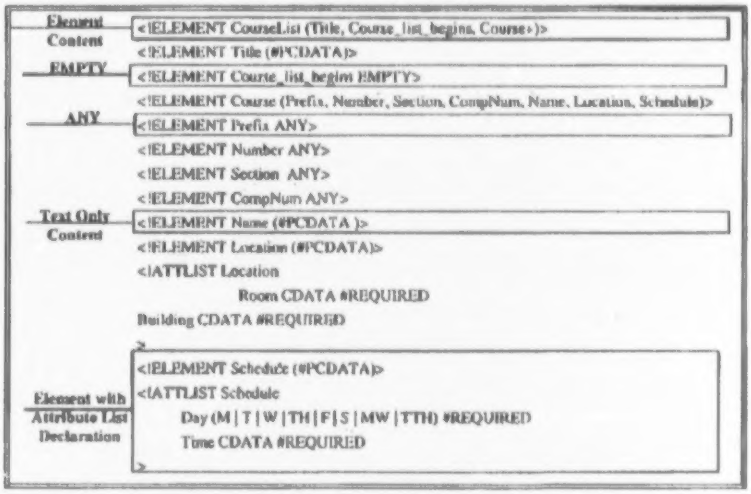
- The Root or Document Element must contain all other elements. The only statements allowed to appear before the Root Element are the XML Declaration, comments or processing instructions.
- All elements must have a start tag and end tag.
- Empty elements must either end with the /> or have both the start and end tags.
- Elements must be properly nested.
- Attribute values must be enclosed in quotes (double quotation marks (“) are the most commonly used).
- XML is case sensitive; NAME and name are not the same.
- Markup characters (< ,&,>, “,’) cannot be used within XML content. Instead their corresponding entity reference must be employed. The predefined entities for the mark up characters are &lt, &amp, &gt, &quot and &apos.

Steps for Constructing the DTD and Schema

The DTD is a coded list that identifies which tags describe data in the XML document. A DTD is not required to create an XML document; however, there are a few advantages to choosing to use a DTD. The DTD creates rules for large sets of documents to follow, which is important for projects with multiple authors, it defines what markup and what sequence should be used, and it provides a common frame of reference for many users to share. A properly used DTD will validate the document. A DTD document is plain text and DTD files are identified by a three-character filename extension of .dtd.

The Document Type Definition is described in six basic components: XML Declaration, Document Type, Element Type, Attribute List, Entity and Notation declarations. Figure 2 shows the DTD for the Course Listing XML document displayed in Figure 1.

FIGURE 2
SIMPLE DTD FOR COURSE LISTINGS



```
<!ELEMENT CourseList (Title, Course_list_begins, Course+)>
<!ELEMENT Title (#PCDATA)>
<!ELEMENT Course_list_begins EMPTY>
<!ELEMENT Course (Prefix, Number, Section, CompNum, Name, Location, Schedule)>
<!ELEMENT Prefix ANY>
<!ELEMENT Number ANY>
<!ELEMENT Section  ANY>
<!ELEMENT CompNum ANY>
<!ELEMENT Name (#PCDATA )>
<!ELEMENT Location (#PCDATA)>
<!ATTLIST Location
                Room CDATA #REQUIRED
Building CDATA #REQUIRED
>
<!ELEMENT Schedule (#PCDATA)>
<!ATTLIST Schedule
        Day (M | T | W | TH | F | S | MW | TTH) #REQUIRED
        Time CDATA #REQUIRED
>
```

The Element Type declaration defines the element type. There are four types of elements.

- Element Content only contains child elements whose order is defined in the declaration.

- ANY content may contain any well-formed XML.

- EMPTY content may not contain anything.

- Mixed Content elements may contain other elements in any order and also may contain text interspersed between elements. A special case of Mixed Content is Text Only where elements are defined to only contain text denoted by #PCDATA. No Mixed Content elements are included in Figure 2. An example would be: <!ELEMENT Name (#PCDATA | ChildName)>.

Symbols in the element type declarations are used to control the occurrences of the elements. Table 2 describes the symbols and their meanings.

TABLE 2
SYMBOLS IN ELEMENT TYPE DECLARATIONS

Symbol	Meaning
,	Listed child elements must be ordered as shown
|	Either one element or the other must be used
	(non-symbol) Required element
+	Child element is used at least once
*	The element is used as many times as needed or none
?	The element is used once or not at all

The Attribute List declaration defines the names, datatypes, and default values of each attribute. The list includes all of the attributes that may be used within a given element. The format for declaring an attribute is be described by using an example.

<!ATTLIST Course Level Enumerated Under | Grad #IMPLIED>

- Course: Element Name
- Level: Attribute Name
- Enumerated: Attribute type
- Under | Grad: possible values delimited by the | symbol
- #IMPLIED: Default value

Possible attribute types available in DTDs are fairly limited. The mostly commonly used are CDATA which allows the attribute to take on any string (text) value and Enumerated that defines a list of all possible values for that attribute. Other attribute types include ENTITY and ENTITIES that allow the insertion of non-text content into an XML document, ID and IDREF which allow unique identifiers to be association with an element and NMTOKEN and NMTOKENS which further constrain string values to a predefined character set.

Possible default values for an element can also be defined in the attribute list declaration. These include:

- #REQUIRED – the value must be supplied in the XML document.
- #IMPLIED – the value may or may not be supplied.
- #FIXED – the value of the attribute is given in the attribute declaration.
- value -- allows a value for the attribute to be assigned in the attribute declaration.

Two other DTD declarations are available but will not be covered in this tutorial. The Entity Declaration defines a set of information that can be called simply by using the entity name. Entities can be thought of as short-cut keys. For instance, if the full name of an institution is frequently referenced, an entity might be created -- <!ENTITY ksu "Kennesaw State University"> -- so that &ksu might be typed in place of the full name. Any output would display the full text. The Notation declaration allows XML documents to refer to external information rather than duplicating data in the program. <!NOTATION Name-List SYSTEM "Names.exe"> for instance, refers the program to the external ID, or file, called Names.exe.

Using a DTD

DTDs are called from within an XML document. A DTD may be used internally or externally depending on the project and preference of the authors. If the DTD is created externally, then it is referenced in the prolog immediately after the XML Declaration. For example, the first two lines of the XML document might be:

<?xml version="1.0">

<!DOCTYPE CourseList SYSTEM "courselist.dtd">

The Document Type declaration tells the processor the location of the DTD, such as a URL or a file path. For example, <!DOCTYPE CourseList SYSTEM "courselist.dtd"> indicates that the DTD called courselist is located locally in the current directory of the system being used. The first instance of CourseList in the example is the root element for the document. The second instance of courselist is the DTD file name.

However, if the DTD is created internally, then the entire DTD is located in the prolog of the XML Document immediately after the XML Declaration within the Document Type Declaration.

When DTDs are applied to an XML document, the content of the document is compared against the definitions in the DTD. XML documents that meet all of the constraints of the DTD, are said to be valid. Validity requires the XML author to fully understand the implications of the limits that are placed on any elements or attributes. Selection clauses should be used to choose one value from a set of possible values or to choose one element from a set of possible elements. Consider offering more than one possible order for data to be input in order to accommodate different types of data. For example, if an address is to be input, consider the different formats that addresses take in other countries by allowing for multiple ordering:

<!ELEMENT Locator ((City, State?, Code?) | (Code?, City, State?))>

Finally, more than one DTD may be applied to an XML document and more than one XML document can use a DTD.

Schema

Schema is an alternative to the DTD; although both techniques may be used together. The primary difference is that the schema is written in the XML format and includes the use of datatypes. The schema provides several built-in datatypes as well additional derived datatypes. Some of the more commonly used datatypes include string, Boolean and those related to numbers (double, decimal, float) and time. Figure 3 depicts the schema for the XML document listed in Figure 1 and the DTD in Figure 2.

Root Element – The XML format requires that a root element be established. In the XML Schema, the root element is 'schema' with an attribute that identifies a namespace. The prefix xsd is mapped to the namespace and used throughout the schema document.

Namespaces – One advantage to XML technologies is the ability to share XML applications. One problem, however, is that the same tag name may be used in both applications but applied differently. Namespaces provide a way to associate elements and attributes to a specific XML application by mapping them to a particular URL. The URL does not have to point to a DTD or schema document. The URL is simply applied as a prefix making element and attribute names unique. Multiple namespaces may be used in an XML document. The namespace declaration appears in the prolog of an XML file. The W3C schema specification, http://www.w3.org/2000/10/XMLSchema, is used in almost every XML Schema.

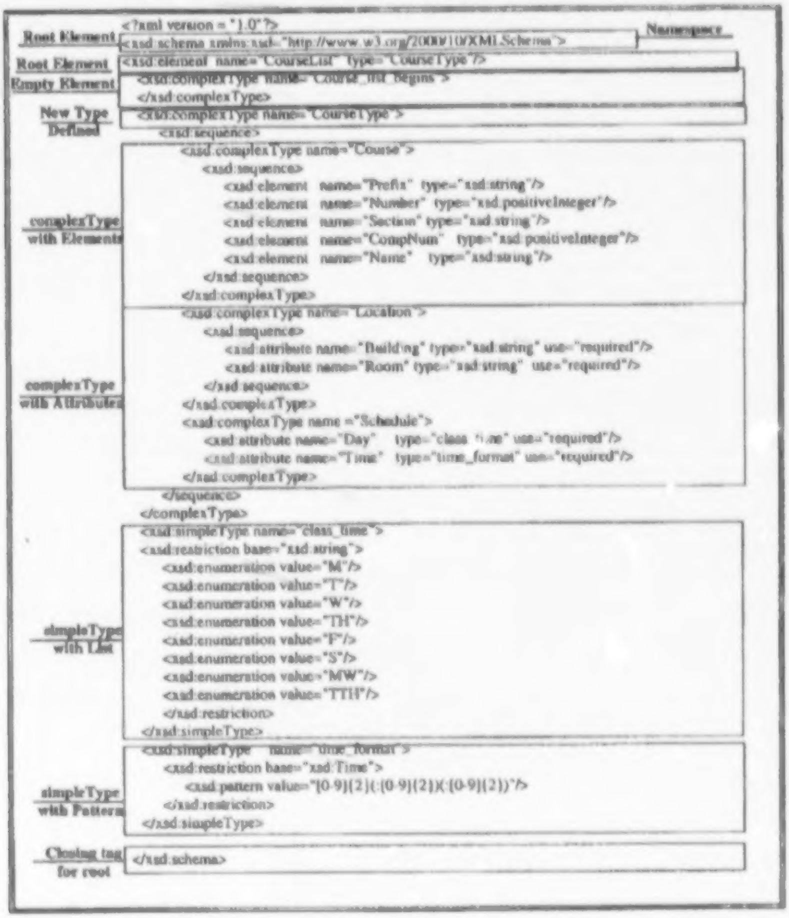
The second root element is the root element of the schema document and usually matches the root element in the XML document. The type is a new type declared later in the schema. The new type contains the elements Course, Location and Schedule. The type is declared to be sequenced indicating the elements are expected to appear in the order presented.

complexType – A schema may contain simpleType and complexType elements. A simpleType element is an element that only contains text and does not have any attributes or child elements. A complexType element may contain elements and/or attributes.

simpleType with enumeration – The schema enumeration is similar to the enumerated component of the DTD attribute. Enumeration limits the element value to a choice from a list of specified values. Within this schema, enumeration is assigned to a simpleType named 'class_time' which is affiliated with the attribute 'Day.'

simpleType with pattern – Pattern allows a format to be assigned to a value. Several options are available for pattern matching. In this schema, the simpleType is constrained to the format of two numbers, a colon, two numbers, a colon and two more numbers. To match the time datatype, an acceptable value would be 09:30:00 indicating hour, minute and seconds respectively. The simpleType, time_format is associated with the Time attribute of the Schedule element.

FIGURE 3
SIMPLE SCHEMA FOR COURSE LISTINGS


Root Element
Namespace
Root Element
Empty Element
New Type Defined
complexType with Elements
complexType with Attributes
simpleType with List
simpleType with Pattern
Closing tag for root

```
<?xml version = "1.0"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2000/10/XMLSchema">
<xsd:element name="CourseList" type="CourseType"/>
  <xsd:complexType name="Course_list_Begins">
  </xsd:complexType>
  <xsd:complexType name="CourseType">
     <xsd:sequence>
        <xsd:complexType name="Course">
           <xsd:sequence>
              <xsd:element  name="Prefix"  type="xsd:string"/>
              <xsd:element  name="Number"  type="xsd:positiveInteger"/>
              <xsd:element  name="Section" type="xsd:string"/>
              <xsd:element  name="CompNum"   type="xsd:positiveInteger"/>
              <xsd:element  name="Name"    type="xsd:string"/>
           </xsd:sequence>
        </xsd:complexType>
        <xsd:complexType name="Location">
           <xsd:sequence>
              <xsd:attribute name="Building" type="xsd:string" use="required"/>
              <xsd:attribute name="Room" type="xsd:string"  use="required"/>
           </xsd:sequence>
        </xsd:complexType>
        <xsd:complexType name ="Schedule">
           <xsd:attribute name="Day"    type="class_time" use="required"/>
           <xsd:attribute name="Time"   type="time_format" use="required"/>
        </xsd:complexType>
     </sequence>
  </complexType>
  <xsd:simpleType name="class_time">
  <xsd:restriction base="xsd:string">
     <xsd:enumeration value="M"/>
     <xsd:enumeration value="T"/>
     <xsd:enumeration value="W"/>
     <xsd:enumeration value="TH"/>
     <xsd:enumeration value="F"/>
     <xsd:enumeration value="S"/>
     <xsd:enumeration value="MW"/>
     <xsd:enumeration value="TTH"/>
     </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType    name="time_format">
     <xsd:restriction base="xsd:Time">
        <xsd:pattern value="[0-9]{2}(:[0-9]{2})(:[0-9]{2})"/>
     </xsd:restriction>
  </xsd:simpleType>
</xsd:schema>
```

Displaying XML

Web browsers that support XML will not understand the tags in any given XML document (unless the tags happen to duplicate an HTML tag), so the style of presentation must be defined for the document. If no style is applied to an XML program, the browser will only show the text of the document.

Two style languages are available for defining the presentation of XML documents. They include the eXtensible Stylesheet Language (XSL) and Cascading StyleSheets (CSS). XSL will provide a wide array of features and functionality for rendering XML content. XSL is still under review by the W3C and has not matured to a standardized form that can be adopted by browsers. CSS is supported, as least partially, by the commonly used browsers. It is still quite challenging to build stylesheets to display XML content. However, it is worthwhile to provide an example. CSS will be demonstrated in this tutorial.

Just as is the case with the DTD, the CSS may be created externally or internally to the XML document. An external CSS is applied by declaring the CSS in the XML document between the XML Declaration and the DOCTYPE (DTD) declaration.

```
<?xml version="1.0">
<?xml-stylesheet  type="text/css"
href="C:\css_CourseList.txt"?>
<!DOCTYPE CourseList SYSTEM "courselist.dtd">
...
```

Figure 4 is an example of a Cascading StyleSheet for displaying the course information contained in the XML document presented in Figure 1. Figure 5 shows the output with the style applied.

The style assigned to the information can easily be changed by applying different stylesheets or by combining multiple stylesheets. For example, if an organization defines a specific look and feel for its Website, but each department within that organization wants to design details for their own Web page, multiple stylesheets can be used to allow them to achieve this objective. A guiding principle is to design an overall stylesheet that provides basic color schemes, layouts, headers, etc. Then design additional stylesheets that cooperate with the overall design but allow for additional details to be customized.

XML Example Scenario

XML includes many more facets than a short tutorial can cover. However, once a basic overview has been presented, considerations and challenges of deploying an XML solution can be explored. As a classroom exercise, scenarios can be presented and students can be asked to outline how XML might be used to facilitate better execution of the business process. Perhaps, the most difficult part in developing an XML application is designing the data model that will be used. Student groups can be assigned to work together to identify the data model and build a simple DTD or schema related to the problem under consideration. Students can then be asked, either individually or in a group, to construct corresponding XML documents. Finally an analysis can be made on how that schema might be utilized. An example scenario is presented below.

Course Transfer Scenario

An activity that frequently occurs within universities is the evaluation of courses for the application of transfer credits. For instance, a student takes a course at University A and then wishes to transfer the credit received for that course to University B. A method commonly employed to facilitate this is for the student to obtain a paper copy of their transcript from University A and submit that paper transcript for review to University B. This manual process is time consuming and often results in a delay before course credit is applied. An automated process would make the course transfer procedure more efficient.XML provides a solution. Figure 6 depicts how XML might be utilized.

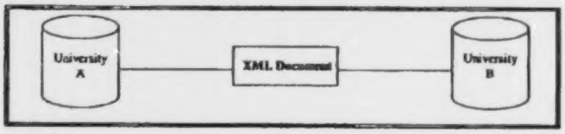
FIGURE 4
EXAMPLE CASCADING STYLESHEET

```
<?xml-stylesheet type="text/css" href="c:\css_CourseList.txt" ?>
<CourseList>
    <st id="css_CourseListt">
        Name{display: block; text-align: left; background-color:gold; color:black;font-size: 100%; font-
style: italic; font-family: sans-serif}
        Prefix+Number+Section{display: block;font-size: 120%; font-style: italic; font-family: sans-serif}
        CompNum {display: none}
        Title {display: block; text-align: center; background-color: black; color: gold; font-size: 140%;
font-style: bold; font-family: serif}
    </st>
</CourseList>
```

FIGURE 5
XML DOCUMENT WITH CASCADING STYLESHEET APPLIED

Information Systems Courses – Fall Semester
CIS 2300 01
Intro to Computing
CIS 3100 01
Information Systems Management
CIS 3601 01
Systems Analysis and Design

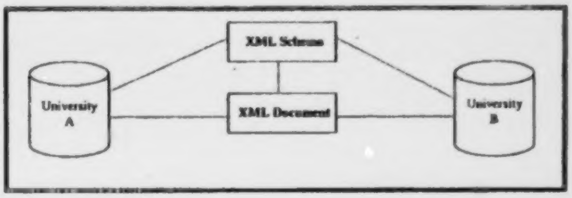
FIGURE 6
APPLYING AN XML DOCUMENT TO THE COURSE TRANSFER SCENARIO



Upon a request from the student, University A extracts information related to the courses the student has taken from its database and writes them to an XML document employing appropriate tags for each data item. The XML document file is then sent over the Internet to University B. University B reads the XML document, extracts needed data and inserts it into their database. Personnel at University B now have access to the courses taken by the student at University A for evaluation of course transfer credit.

However, for this process to be successful, there is a caveat. University A and University B have to agree on the tags used in the XML document. This requires the two institutions to develop a proprietary agreement in relation to the contents of the XML document that both institutions must follow explicitly. For instance, a name can be presented in several ways; First-name, Last_name and Middle_initial as three separate elements or as three attributes of one element. The XML document created by University A would not be usable by University B if University A chooses to use attributes when University B was expecting elements.The XML solution to this is to develop a DTD or schema that is shared by both institutions. (In fact, this schema can be shared with other institutions as well). The schema provides the data definition for what can be contained in the XML document. Figure 7 depicts the process when a schema is used.

FIGURE 7
APPLYING A SCHEMA TO THE COURSE TRANSFER SCENARIO



University A has access to the common schema and now the data that is extracted from their internal database is written to an XML document that follows the definitions in the schema. Further, the XML document is validated against the schema to insure compliance. The validated document is sent across the Internet to University B. University B knows exactly what data has been sent because they also have access to the schema. One major advantage of using the schema is that this process is extensible to other institutions given access to the schema.

Within the classroom, students can be assigned to pseudo organizations and charged with the task of developing a schema or DTD for this scenario. Each group's final product will be slightly different. Ultimately, however, only one common data definition can be used. (This usually translates to one common schema although the data definition could span multiple schemas.) The pseudo organizations will need to work together to reach an agreement on one common schema or DTD. Students can then be assigned the task of developing individual valid XML documents. This exercises allows students to explore many of the challenges faced by organizations working to apply XML technologies.

CONCLUSION

XML and its associated standards have the potential to impact the way systems are developed and the way organizations share information. While expertise in XML syntax will not be necessary for all IS professionals, understanding how the technology works and how the data is defined within that technology will be paramount to making informed decisions on the appropriate implementation of XML. Implementation will not be revolutionary; it requires an evolutionary approach that includes introspection of internal data models and reconciliation with data models from organizations to which information will be exchanged. XML should not be viewed as just another Web technology; but as a foundational technology that will transform the IT infrastructure.

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USING IT TO TEACH PROJECT MANAGEMENT IN THE MBA CORE

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Extended Abstract

We report on the evolution of a course in Information Technology (IT) Project Management from an elective to a required core course in the MBA program at the University of Tampa's John H. Sykes College of Business. This course is offered in the Information and Technology Management (ITM) department.

In its current from the course, called "Effective Project Management," is a seven-week course linked to the capstone course on Strategic Analysis. Students are required to take both courses in the same semester, Effective Project Management for the first seven weeks of the semester, and Strategic Analysis for the entire 14-week semester. In the Strategic Analysis course, student teams are required to act as strategy consultants to client companies in the Tampa Bay area. In addition, teams are required to use project management concepts and MS Project 2000 to manage their consulting projects.

In January 2000, we offered this course for the first time as Special Topics in ITM elective. Most students took the course to fulfill requirements for a Concentration in Information Systems Management (ISM). We met for 4.5 hours a night, five times a week for two weeks. We used a book by Kathy Schwalbe entitled "Information Technology Project Management." The book came bundled with a 120-day trial version of Microsoft Project 98.

In its original form this course was described as a study of IT project management using the systems approach to problem solving. We covered all nine project management knowledge areas—project integration, scope, time, cost, quality, human resources, communications, risk, and procurement management—and all five process groups—initiating, planning, executing, controlling, and closing. We used Microsoft Project 98 to illustrate all concepts.

On the first day of class we divided students randomly into teams of three or four, and we made random assignments of IT projects to groups. Lecture and discussion were limited to two hours per meeting. Teams used the remaining time to work on their projects using MS Project 98. We reserved the last meeting of class for team presentations. Project write-ups were due the following week.

Student response was overwhelmingly positive that the course was offered four additional times, August 2000, January 2001, May 2001 and August 2001. In the meantime, the MBA program was redesigned to, among other things, add more value to the capstone experience, where student teams apply project management concepts and use MS Project 2000 to manage their strategic analysis consulting projects.

Because of this MBA redesign, the course is now called "Effective Project Management." It is to be offered every each fall and spring semester in the first seven weeks. In addition, the course is slightly changed to reflect the fact that it is required of all MBA students and that it is linked to the Strategic Analysis course. We continue, however, to use the same book, albeit the latest edition, which is bundled with MS Project 2000. One of the main reasons for continuing to use this book, an IT

Project Management book, is the fact that it is designed to reflect concepts and techniques in the Project Management Body Of Knowledge Guide 2000 as put forth by the Project Management Institute.

Beginning fall 2001, we offer this course in its new format for the first time. In the remainder of this paper, we will examine the link to the Strategic Analysis course, describe the newly redesigned course in greater detail, explain why we use IT projects to illustrate project management concepts, explain why we continue to use the Schwalbe book, and report on initial student feedback.

E-BUSINESS AND THE GLOBAL ADAPTATION OF MBA PROGRAMMES GENERALIZING OR SPECIALIZING MBA MAJORS TOWARDS E-BUSINESS?

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ABSTRACT

E-Business oriented management education programmes are currently founded all over the globe and becoming competitors for existing and successful MBA programmes. The primary objective of an MBA programme is to obtain top quality management training in the field of business, in a conductive environment with all the necessary resources available, and easy access to faculty. It has the most up-to-date teaching methods and the knowledge transmitted is state of the art.

With this paper we like to present the results of a global survey which was carried out to analyse the various efforts being undertaken by MBA programmes around the globe to adapt their curricula with the advent of the E-Business age. The results of our survey—conducted for the second time after a two year period—will show a significant trend towards integration of E-Business relevant topics in existing majors versus the formation of new majors specializing in E-Business.

INTRODUCTION

MBA programmes around the globe provide graduate management training in the field of business/ management with the option to specialize in certain business areas. The training offered is most often intended to be very practical instead of highly theoretical. The curriculum is usually divided into two parts consisting of a core part, which covers the fundamental areas of business, (some of these courses may be waived for people having previously studied the subjects in question) and an elective part, where students can take courses of special interest and perhaps specialize in a major field of business. Possible areas of interest offered range from finance, marketing and accounting to health care management, arts management, etc. [8].

The need for changes to the content of MBA courses has grown extensively. The business world is changing rapidly every year. New business models are adding to already-existing market forces. Successful management in the e-business age is demanding new IT-based skills and IT-based knowledge. The first survey of this research project was conducted two years ago. Targeting more than 460 MBA programmes around the globe it showed quite clearly that the majority of the programmes had not integrated IS/IT applications and topics in their core curricula but planned to do it in the future [9] [10]. Concerning application skills the majority of programme directors believed that these skills should not be taught as part of the programme at all. With regard to all Internet related topics the findings of the survey confirmed the hypothesis that there was a significant change in the importance of curriculum content. In expanding our research project we decided to carry out a follow-up survey covering the most interesting question of the integration of the new content in the MBA curriculum core. We tried to gain more insight into the MBA curricula changes to find whether these IS/IT related topics which were getting more important in the future were being integrated in existing core courses or were being taught in enrichment and elective courses (covering problems like multidisciplinary or cross course integration).

MANAGEMENT SKILLS FOR THE E-BUSINESS AGE

During the last years, significant efforts have been made in the IS field to put forward general recommendations for curriculum guidelines for Master Programmes in Information Systems. These efforts were being spearheaded by the joint ACM/AIS Curriculum Committee on IS Curriclula. This group suggests [6] that the output of any new programme should create people with the following characteristics.

- Broad business and real-word perspective
- Communication, interpersonal, and team skills
- Analytical and critical thinking skills
- Integrated IT and business foundations, a core of IS, and specific skills leading to a career.

As many important business issues are nowadays at least to some extent IS issues it is quite clear that efforts are being required to adopt current curricula. Figure 1 shows Wigands, Picots and Reichwalds assumption of the potential for innovation, competitive markets and innovation strategies.

Nevertheless, the vast majority of general management jobs still have a strong business profile and career track (marketing & sales, finance, human resource management, etc.). Today the number of new market challenges is also placing new essential demands on the manager such as mastery of newer information and communication technologies [i]. As a result MBA curricula are also having to adapt to the challenges and requirements of the e-business age. The modern MBA graduate should be a general manager, capable of refreshing a company, communicating visions and goals. He has to be flexible and open to new ideas and business models [7]. With regard to skills and knowledge an MBA graduate should know about the relevant business potential of ERP systems and the Internet, know how to use executive information systems, have at least a strong knowledge of e-business issues and e-business based implications on different managerial areas. By collecting data from and combining the results of different research projects and surveys [5] [1] [4] [3] [2] [13] [11] [12] we had created a checklist of prerequisites of IS/IT-skills and IS/IT related managerial topics for the e-business age.

Together with the data collected from our first global survey we derived different clusters of possible relevant E-Business related curriculum content. Based on that we searched for a matching framework of parameters which should help us in operationalizing our hypotheses. We used the framework of Werthner and Klein [14] to identify the relevant parameters influencing the building of an E-Business strategy as well as relevant external parameters for management decisions in the area of E-Business.

RESEARCH QUESTION AND HYPOTHESES

Given the knowledge that MBA programme managers planned to adapt their curricula and wanted to include E-Business relevant content and monitoring the ongoing various economic changes and technological developments we therefore wanted to *analyze whether these E-Business related topics which were getting more important in the future were being integrated in existing core courses or were being taught in enrichment and elective courses (covering problems like multidisciplinary or cross course integration) or were still being neglected.*

To analyze the situation we formulated the research question stated above taking into account some of the necessities and prerequisites to adapt MBA curricula in order to successfully react to market needs in the E-Business age.

FIGURE 1
CHANGES IN COMPETITIVE ENVIRONMENT AND CORPORATE STRUCTURES [15]

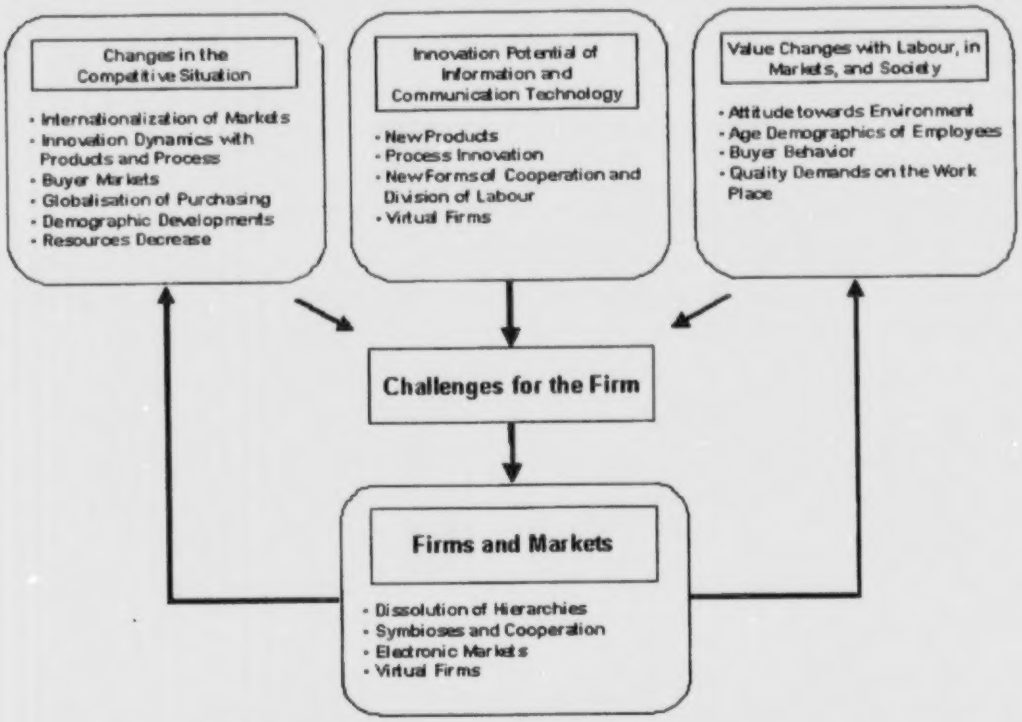
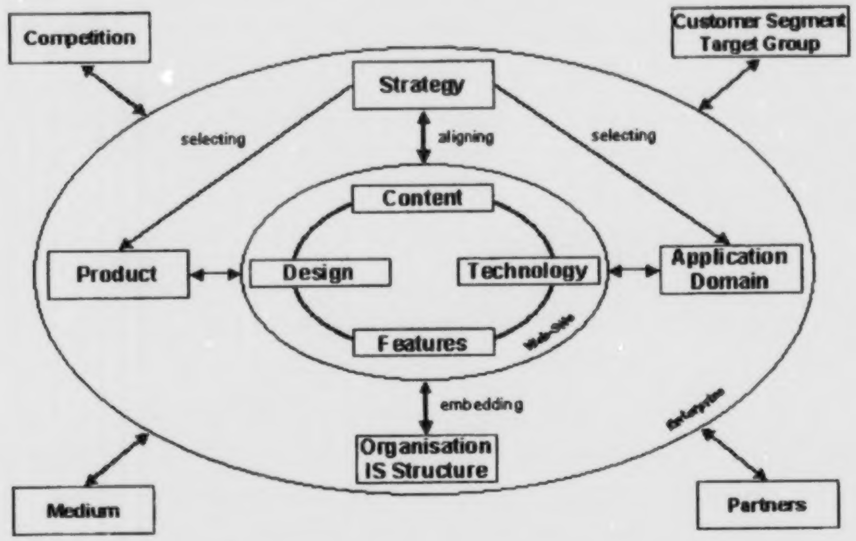

Changes in the Competitive Situation
- Internationalization of Markets
- Innovation Dynamics with Products and Process
- Buyer Markets
- Globalisation of Purchasing
- Demographic Developments
- Resources Decrease
Innovation Potential of Information and Communication Technology
- New Products
- Process Innovation
- New Forms of Cooperation and Division of Labour
- Virtual Firms
Value Changes with Labour, in Markets, and Society
- Attitude towards Environment
- Age Demographics of Employees
- Buyer Behavior
- Quality Demands on the Work Place
Challenges for the Firm
Firms and Markets
- Dissolution of Hierarchies
- Symbioses and Cooperation
- Electronic Markets
- Virtual Firms

FIGURE 2
E-BUSINESS RELATED PARAMETERS INFLUENCING MANAGEMENT DECISION MAKING


Competition
Customer Segment
Target Group
Strategy
selecting
aligning
selecting
Content
Product
Design
Technology
Application Domain
Features
Web-Site
embedding
Enterprise
Organisation
IS Structure
Medium
Partners

We then derived a main hypothesis to be tested in a survey covering the same MBA programmes of our first global survey.

MBA programmes have identified and reacted to the new managerial challenges and skills required for E-Business.

To find answers to our research question we operationalized our main hypothesis by formulating **six hypotheses** to be tested during our study:

If MBA programmes have identified and reacted to the new managerial challenges and skills required for the E-Business age then:

- *the majority of all MBA programmes have or will establish special E-Business majors within their curricula* ***(Hypothesis 1)***
- *the majority of all MBA programmes will increase the coverage of E-Business related technology infrastructure in their curricula in the future* ***(Hypothesis 2)***
- *the majority of all MBA programmes will increase the coverage of E-Business related organizational applications in their curricula in the future* ***(Hypothesis 3)***
- *the majority of all MBA programmes will increase the coverage of E-Business related policy issues in their curricula in the future* ***(Hypothesis 4)***
- *the majority of all MBA programmes will expand the use and teaching of IS/IT-skills in their curricula in the future.* ***(Hypothesis 5)***
- *the majority of all MBA programmes will increase the overall coverage of E-Business based applications and E-Business based topics as electives in their curricula in the future* ***(Hypothesis 6)***

RESEARCH METHOD—DESIGN OF THE STUDY

The research team decided that a survey with a detailed questionnaire would be the most appropriate method of collecting the required data to find answers to our research questions and to test our hypotheses.

MBA programmes all around the globe were defined as the unit of analysis of this part of the survey. As far as possible programme directors were addressed directly. Prior to sending out the questionnaire a pre-test was carried out with selected European MBA programme directors which should resemble the actual respondents for the survey. After conducting the pre-test we had identified questions which had been difficult to interpret; we clarified terms and definitions; we eliminated unnecessary questions and had identified the time required to go through all the questions.

The final version of the questionnaire was sent out to 466 MBA programmes around the globe. After the deadline 121 completed questionnaires had been returned, giving an average response rate of 25,96%. Figure 3 is showing sample response rates for different global regions of our survey (During our 1998 survey 102 questionnaires had been returned with a response rate of 21,89%.).

FINDINGS OF THE STUDY

In Figure 4 we present some sample findings of our study concerning the hypotheses developed according to our research question. The testing of the hypotheses gave a good picture concerning the preparations and adoptions of MBA curricula for the electronic business age. For each hypothesis there was a number of operationalized questions being included in the questionnaire. The following section is showing aggregated and clusterd results.

Hypothesis 1

The majority of all MBA programmes have or will establish special E-Business majors within their curricula ***(Hypothesis 1)****.*

As Figure 4 is showing the majority of all MBA programme directors 72.1 % have not established or are not planning to establish special E-Business majors in the future.

FIGURE 3
SURVEY RESPONSE RATE

	Africa	Australia & Asia	Europe	North America	South America	Total
1998 Sent out questionnaires	11	113	115	136	91	466
2000 Sent out questionnaires	**11**	**113**	**115**	**136**	**91**	**466**
1998 Returned questionnaires	3	16	37	32	14	102
2000 Returned questionnaires	**5**	**27**	**35**	**41**	**13**	**121**
1998 Response rate	27,27%	14,16%	31,18%	23,53%	15,38%	21,89%
2000 Response rate	**45,45%**	**23,89%**	**30,43%**	**30,14%**	**14,28%**	**25,96%**

FIGURE 4
E-BUSINESS MAJORS

Establishment of E-Business Majors

Yes	127	27,26%
No	336	72,10%
N.A.	3	0,64%
Total	486	100,00%

Hypothesis 2

The majority of all MBA programmes will increase the coverage of E-Business related technology infrastructure in their curricula in the future ***(Hypothesis 2)****.*

Hypothesis 3

The majority of all MBA programmes will increase the coverage of E-Business related organizational applications in their curricula in the future ***(Hypothesis 3)****.*

FIGURE 5
E-BUSINESS RELATED TECHNOLOGY INFRASTRUCTURE

Increase the coverage of E-Business related technology infrastructure

Yes	289	62,02%
No	170	36,48%
N.A.	7	1,50%
Total	466	100,00%

Hypothesis 4

The majority of all MBA programmes will increase the coverage of E-Business related policy issues in their curricula in the future ***(Hypothesis 4)****.*

FIGURE 6
E-BUSINESS RELATED ORGANIZATIONAL APPLICATIONS

Increase the coverage of E-Business related technology infrastructure

Yes	391	83,91%
No	71	15,23%
N.A.	4	0,86%
Total	466	100,00%

FIGURE 7
E-BUSINESS RELATED POLICY ISSUES

Increase the coverage of E-Business related technology infrastructure

Yes	372	79,83%
No	92	19,74%
N.A.	2	0,43%
Total	466	100,00%

Concerning special E-Business related topics covering the areas of technology infrastructure (www technology, hardware, software, applications, payment systems, authentication and security systems, etc.), organizational applications (business models, operational and strategic perspectives, pricing, marketing, logistics, etc.), and policy issues (legal and policy issues, privacy, content selection and rating, intellectual property rights, tax implications, etc.) figures 5 to 7 show a significant increase in the coverage in all three areas.

Hypothesis 5

*The majority of all MBA programmes will expand the use and teaching of IS/IT-skills in their curricula in the future **(Hypothesis 5)**.*

These numbers support a very homogeneous picture which we already identified and painted after our last survey. The majority of MBA programmes do not want IS/IT skills to be taught as part of the programme at all. Therefore it should be no wonder that the vast majority of programme directors are not planning to expand the use and teaching of IS/IT skills in their curricula.

FIGURE 8
EXPANDING THE USE AND TEACHING OF IS/IT-SKILLS

Expanding the use and teaching of IT/IS-skills

Yes	109	23,39%
No	355	78,18%
N.A.	2	0,43%
Total	466	100,00%

Hypothesis 6

*The majority of all MBA programmes will increase the overall coverage of E-Business based applications and E-Business based topics as electives in their curricula in the future **(Hypothesis 6)**.*

FIGURE 9
E-BUSINESS ELECTIVES

Increase the overall coverage of E-Business based applications and topics as electives

Yes	419	83,91%
No	43	9,23%
N.A.	4	0,86%
Total	466	100,00%

By asking about the roll of electives as possible solution for increasing the overall coverage of E-Business based applications and topics the survey showed a significant positiv trend. Nearly 90% of all MBA programme directors are planning to increase the offer of E-Business related electives.

CONCLUSIONS

During the testing of our six hypotheses four of them could be confirmed as can be seen in Figure 10 giving us a more or less clear answer to our overall research question. This study shows that there is significant effort to change and adapt MBA curricula in E-Business related areas. The results of our survey show a significant trend towards integration of E-Business relevant topics in existing majors and an increase in the supply of E-Business related electives versus the formation of new majors specializing in E-Business. Concerning all Internet related topics the in-depth findings of the survey did not show that there was a significant change in the importance of curriculum content compared to the survey of 1998.

FIGURE 10
HYPOTHESES TESTING SUMMARY

	confirmed	not confirmed
Hypothesis 1		✓
Hypothesis 2	✓	
Hypothesis 3	✓	
Hypothesis 4	✓	
Hypothesis 5		✓
Hypothesis 6	✓	

Expanding our research project in the near future we will try to compare our findings with a planned survey covering the vast number of specialized E-Business and E-Commerce programmes which have been and currently are established all over the globe. So far there are no clear boundaries for outlining the curriculum to make it clear what content is taught in which programmes and courses.

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STUDENT LEARNING STYLES & DISTANCE LEARNING

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ABSTRACT

Distance learning is quickly becoming an accepted and even necessary part of college and university programs. As more colleges and universities join the growing ranks of institutions offering distance learning, educators and administrators are struggling with the issue of how to assess student success in this new and largely untested environment. Many distance learning providers, and even some institutions, have developed short surveys that are designed to gauge whether a student is prepared to undertake distance learning. These tests, however, may not accurately assess a student's predisposition and learning style. This paper highlights and compares the use of different learning style inventories as a means to formally and empirically assess learning styles. Students in both distance learning and traditional classroom courses were given several of these inventories and their progress was tracked. Initial results indicate that some of these can be used as a successful predictor of student performance and may be useful for students and administrators in determining whether or not the student should undertake a distance learning course or program. The paper concludes with some suggestions and implications for educators on distance learning.

INTRODUCTION

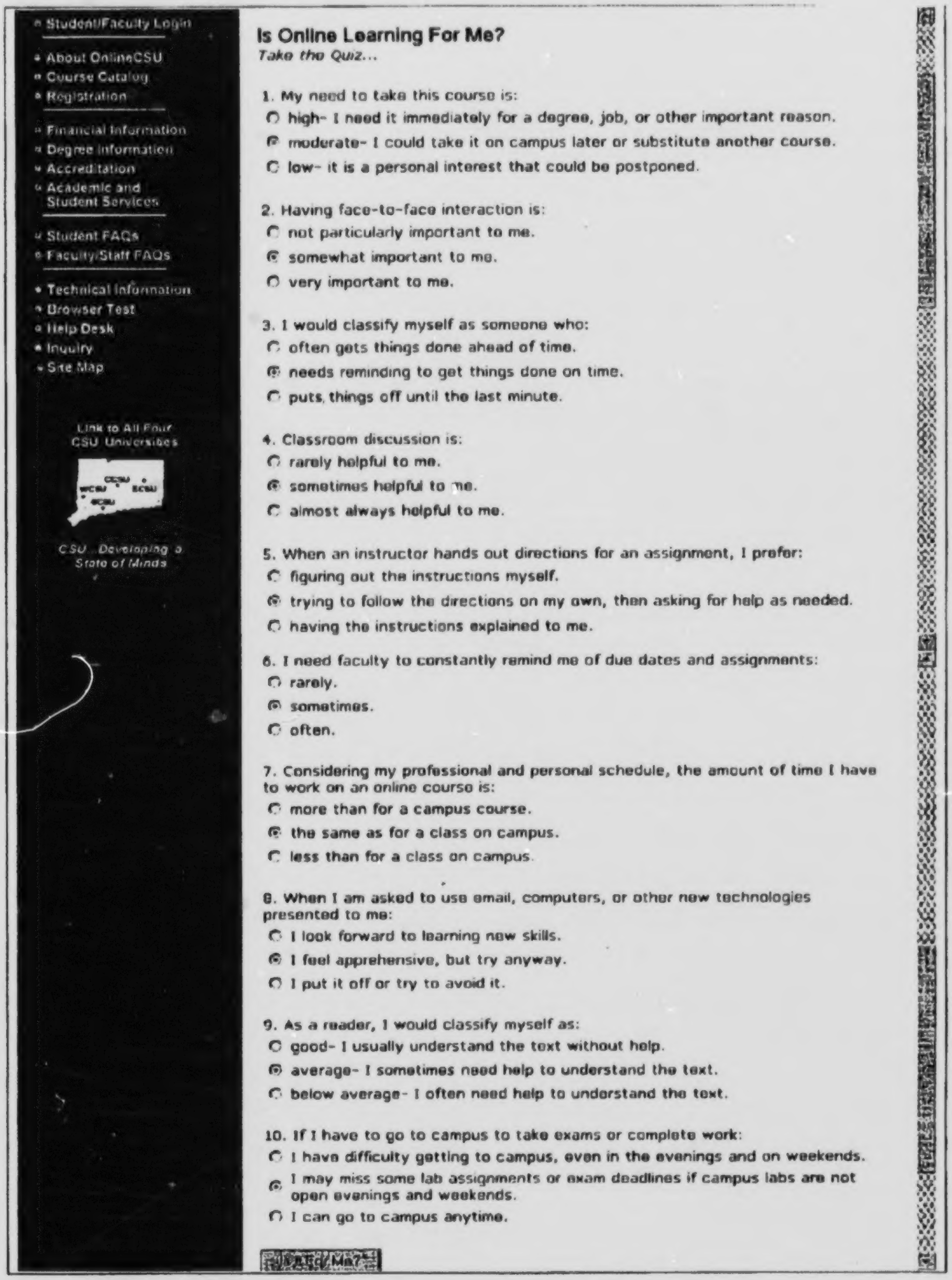
Distance learning has become an established, accepted part of many college and university offerings and, in some cases, represents a major portion of the curricula. Given the technological advances and broad reach of the Internet, this is not surprising. Students and administrators alike are demanding such programs given the changing student demographics and societal needs. As the traditional college populations change, the need for programs which address convenient, flexible, and adaptable learning increases. Life-long learning and re-tooling also necessitate programs which can accommodate full-time workers and those with familial obligations. Need notwithstanding, distance learning providers have not spent much time investigating whether or not this new pedagogy is suitable for everyone and how to assess who might benefit from it.

Many institutions offer distance-learning courses and/or programs but have little or no pre-assessment for students. They feel that the need for such courses and programs is justified, however they often do not provide a way for prospective students to assess their level of readiness for such programs. This is especially true for those students who have been away from the classroom environment for some time and are now returning to continue a course of study or re-tool in a new area. This paper begins with an exploration of some of the ways in which students are currently tested, highlights and compares several different learning style inventories, and presents initial findings from both on-campus and on-line classes with respect to student learning styles. It concludes with general suggestions for educators and administrators on how to assess student readiness for this new environment. Future research will gather data from a much larger population to assess which learning style assessment, if any, is most suitable for assessing student readiness for this new and largely unexplored pedagogy.

EXISTING ASSESSMENTS

A few of the commercial distance learning providers have developed their own self-assessment surveys or questionnaires to assist students in deciding whether or not to undertake a distance learning course or program.

Some are very short, others are more comprehensive and thorough. For example, one of the providers, eCollege™, uses a short 10-question quiz to assess potential student success (http://www.onlinecsu.ctstateu.edu/index.real?action=IsOnline).


Student/Faculty Login
About OnlineCSU
Course Catalog
Registration
Financial Information
Degree Information
Accreditation
Academic and Student Services
Student FAQs
Faculty/Staff FAQs
Technical Information
Browser Test
Help Desk
Inquiry
Site Map
Link to All Four CSU Universities
CCSU
WCSU
ECSU
SCSU
CSU...Developing a State of Minds

Is Online Learning For Me?

Take the Quiz...

1. My need to take this course is:
○ high- I need it immediately for a degree, job, or other important reason.
● moderate- I could take it on campus later or substitute another course.
○ low- it is a personal interest that could be postponed.

2. Having face-to-face interaction is:
○ not particularly important to me.
● somewhat important to me.
○ very important to me.

3. I would classify myself as someone who:
○ often gets things done ahead of time.
● needs reminding to get things done on time.
○ puts things off until the last minute.

4. Classroom discussion is:
○ rarely helpful to me.
● sometimes helpful to me.
○ almost always helpful to me.

5. When an instructor hands out directions for an assignment, I prefer:
○ figuring out the instructions myself.
● trying to follow the directions on my own, then asking for help as needed.
○ having the instructions explained to me.

6. I need faculty to constantly remind me of due dates and assignments:
○ rarely.
● sometimes.
○ often.

7. Considering my professional and personal schedule, the amount of time I have to work on an online course is:
○ more than for a campus course.
● the same as for a class on campus.
○ less than for a class on campus.

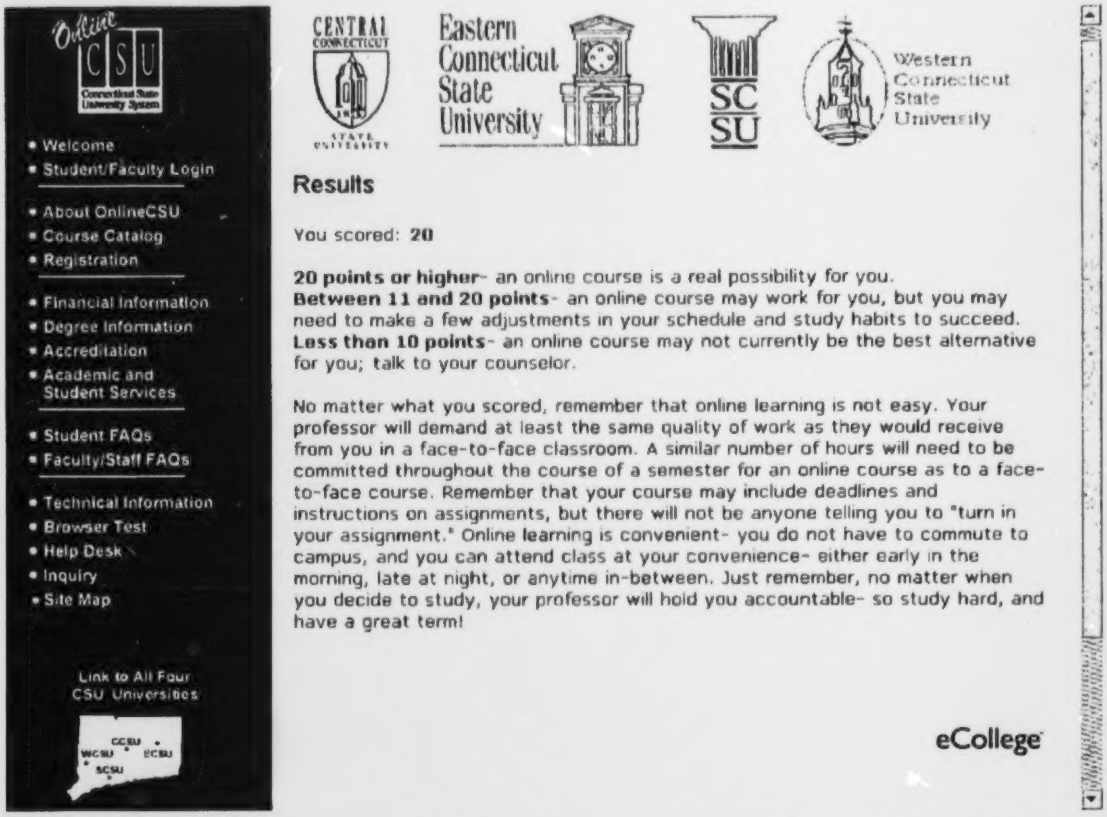
8. When I am asked to use email, computers, or other new technologies presented to me:
○ I look forward to learning new skills.
● I feel apprehensive, but try anyway.
○ I put it off or try to avoid it.

9. As a reader, I would classify myself as:
○ good- I usually understand the text without help.
● average- I sometimes need help to understand the text.
○ below average- I often need help to understand the text.

10. If I have to go to campus to take exams or complete work:
○ I have difficulty getting to campus, even in the evenings and on weekends.
● I may miss some lab assignments or exam deadlines if campus labs are not open evenings and weekends.
○ I can go to campus anytime.

BEST COPY AVAILABLE

The results of the exam, given a "middle of the road" set of responses as indicated above, are:


Online CSU
Connecticut State University System
Welcome
Student/Faculty Login
About OnlineCSU
Course Catalog
Registration
Financial Information
Degree Information
Accreditation
Academic and Student Services
Student FAQs
Faculty/Staff FAQs
Technical Information
Browser Test
Help Desk
Inquiry
Site Map
Link to All Four CSU Universities
CCSU
WCSU
ECSU
SCSU
Central Connecticut State University
Eastern Connecticut State University
SCSU
Western Connecticut State University
eCollege

Results

You scored: **20**

20 points or higher- an online course is a real possibility for you.
Between 11 and 20 points- an online course may work for you, but you may need to make a few adjustments in your schedule and study habits to succeed.
Less than 10 points- an online course may not currently be the best alternative for you; talk to your counselor.

No matter what you scored, remember that online learning is not easy. Your professor will demand at least the same quality of work as they would receive from you in a face-to-face classroom. A similar number of hours will need to be committed throughout the course of a semester for an online course as to a face-to-face course. Remember that your course may include deadlines and instructions on assignments, but there will not be anyone telling you to "turn in your assignment." Online learning is convenient- you do not have to commute to campus, and you can attend class at your convenience- either early in the morning, late at night, or anytime in-between. Just remember, no matter when you decide to study, your professor will hold you accountable- so study hard, and have a great term!

(http://www.onlinecsu.ctstateu.edu/index.real?action=IsOnline)

ANALYSIS

While the results may be helpful to a student, the point system illustrated above is vague and a variation on only one or two answers could result in a recommendation against distance learning. While the eCollege™ survey is easy to take, the accuracy of the results might be questionable in that students are not asked specific questions about their learning styles but rather more about the environment (e.g., their level of comfort with technology, ability to visit campus, and/or need for contact with the instructor).

It is interesting to note that as of mid-2001, national institutions such as the University of Phoenix™, Jones International University™ and Western Governors University™ do not offer any type of pre-assessment. They encourage the student to enroll and work with a counselor and/or technical support personnel to bring them up to speed in their environment. This is a common approach, but one that may subject the student to unnecessary stress as they attempt to work out their difficulties and determine the suitability of a distributed learning environment.

So how does a student determine if he/she will be successful in a distance-learning environment? They could enroll in one of these national or local institutions and "learn the ropes" and hope that they will be able to handle the rigors of learning without the benefit of an actual classroom setting. For older students and those who already have substantial work experience and/or a previous degree, this may not be a difficult adaptation. Students who will potentially require more assistance are those whose learning styles may not be amenable to a non-classroom setting. Local and regional institutions in particular may target their own students or those in the local area rather than a national or international clientele. It is for these institutions that a more comprehensive assessment of learning style is beneficial (Sternberg, & Grigorenko, 1997).

OVERVIEW OF LEARNING INVENTORIES

There are numerous learning style assessments currently available. Some were designed for learning assessment in general while others have been adapted or modified to accommodate many of the newer learning styles and pedagogies.

One of the oldest and most well known ways of assigning students to a given learning style is that of Kolb's (1984) Learning Style Inventory (LSI). This assessment inventory consists of 36 words in 9 groupings of 4 each. The student is asked to rank each of the sets of words on a 1 to 4 scale, with 1 equating to least like the person, 4 being the most like the person. The four columns of words correspond to four learning style scales: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Kolb uses Jung's (1977) typologies as the main foundation in the development of these learning styles. For example, the abstract conceptualization (AC) style "focuses on using logic, ideas, and concepts. It emphasizes thinking as opposed to feeling" while the concrete experimentation (CE) style "focuses on being involved in experiences and dealing with human situations in a personal way. It emphasizes feeling as opposed to thinking" (Kolb, 1984, 68-69).

Kolb's LSI has been criticized for its low reliability and validity measures (Freeman & Stumpf, 1978; Holman, Pavlice & Thorpe, 1997; Lamb & Certo, 1978; West, 1982), yet it has received equal support as a way of illustrating the different approaches to learning (Abbey et al, 1985; Kruzich et al, 1986; Nulty & Barrett, 1996; Raschick et al, 1998). As a result of the diverse opinions and findings, other methodologies are needed to provide a more stable platform with respect to validity and reliability of such an assessment. Other methodologies which will be included in this investigation include Tait and Entwistle's ASSIST (1996), Solomon and Felder's (1996) Index of Learning Styles (ILS), Honey and Mumford's (1992) Learning Styles Questionnaire (LSQ) and the Academic Self-Efficacy Scale (Eachus, 1993).

The ASSIST (Approaches and Study Skills Inventory for Students) instrument developed by Tait and Entwistle (1996) is a 38-item inventory which attempts to identify students with weak study strategies. It has four subscales which measure four approaches of studying and academic aptitude. The scales are deep (intention to understand, relation of ideas, active learning), surface (intention to reproduce, unrelated memorizing, passive learning), strategic (study organization, time management, intention to excel), and apathetic (lack of direction and interest). Students respond to items relating to each of these approaches along a five-point likert scale from "agree" to "disagree". A score for each of the approaches is determined by summing the scores from each of the items corresponding to each subscale.

Solomon and Felder's (1996) Index of Learning Styles (ILS), originally developed for engineering students, focuses on four bi-polar preference for learning scales. These include Active-Reflective, Sensing-Intuitive, Visual-Verbal, and Sequential-Global (Felder & Silverman, 1988). Active learners are those who learn by trying things and working with others. Reflective learners prefer to think things through and work alone. Sensing learners are oriented toward facts and procedures while Intuitive learners are more conceptual, innovative and focus on theories and meanings. Visual learners prefer visual representations of material such as pictures, diagrams and charts while verbal learners prefer written or spoken explanations. Sequential learners are linear and orderly in their thinking and learn in small incremental steps while Global learners are holistic thinkers who learn in large leaps. These bi-polar scales offer a good basis for comparison of learning types.

The Learning Styles Questionnaire (LSQ) developed by Honey and Mumford (1992) identifies four types of learners, Activists (e.g. enjoy new experiences, make intuitive decisions, dislike structure), Theorists (e.g. focus on ideas, logic and systematic planning, mistrust intuition), Pragmatists (e.g. favor practical approaches, group work, debate, risk-taking), and Reflectors (e.g. observe and describe, try to predict outcomes, try to understand meaning). According to the authors, individuals tend to rely on one of these approaches when they are engaged in learning.

Finally, the Academic Self-Efficacy Scale (Eachus, 1993) is a 23-item scale which assesses the extent to which students believe they have the ability to exert control over their academic environment. By totaling the scores from the items, a self-efficacy score can be determined. This can be useful for students to determine the extent to which a distance-learning environment will be suitable for them. By knowing their level of self-efficacy, they will be in a better position to make a decision as to whether or not to pursue a more traditional course of study.

METHODOLOGY & PRELIMINARY RESULTS

Each of the assessment inventories highlighted above were administered to students in an on-campus sophomore level computer class focusing on hardware, software and networking. The same inventories were administered to students in a distance-learning course conducted during the summer of 2001. The course covered the same content as the on-campus course, but was delivered entirely over the Internet.

Preliminary analysis regarding each of the learning styles is presented below. A total of 40 students took part in this pilot study. 25 took the traditional on-campus class and 15 took the distance-learning class over the summer. The mean age was 19 for the on-campus class and 20 for the distance-learning class. There were 15 women and 10 men in the on-campus section and 11 men and 4 women in the on-line section. All were classified as full-time students although 80% reported working at least 20 hours per week while they took the courses. It must be noted here that this small sample size prevents the results that follow from being generalized to the general population. It is the author's intention to undertake a full study given the promising results of this initial pilot study.

Kolb categorizes four learning styles: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Analysis of the sample indicates that 75% of the students responded as Abstract Conceptualizers (AC) and 85% classified themselves as Active Experimenters (AE). Given the subject of the course, computer hardware and software, this is not surprising. It is interesting to note that more women (13%) then men (7%) categorized themselves as Reflective Observers (RO). This might be indicative of male-female personality differences, but this cannot be verified given the sample.

Analysis of Tait and Entwistle's (1996) ASSIST (Approaches and Study Skills Inventory for Students) instrument indicates that men (12%) are more inclined to be surface learners (e.g. more passive and inclined to memorize) than women (8%). Women outnumber men almost two-to-one in terms of deep (active learning, idea relation) learning (28% to 15%). Few students indicated an apathetic learning style and most were highly focused on strategic learning. Incidentally, this focus was much more pronounced in the on-line class (82%) than in the on-campus class (68%), possibly suggesting a greater need for time management and organization. This may have been the result, however of the shortened (six-week) class time period.

Solomon and Felder's (1996) Index of Learning Styles (ILS) focuses on four bi-polar scales. Active Learners try things out and prefer working with others while Reflective learners prefer to work alone and think things through. Students in both classes were largely Reflective learners, however this may be the result of their age and lack of experience with group settings. Sensing learners are more fact-oriented and Intuitive learners are more conceptual. Not surprisingly, students were more Sensing (87%) than Intuitive (56%), probably a result of their chosen major, computer information systems. People with an aptitude toward computers tend to be sensing and thinking which is in line with the Myers-Briggs Type Indicator. Students were also more Visual (92%) then Verbal (8%). This may be largely the result of age. Generation Y has grown up in a much more visually-oriented world and results may differ greatly if the population were not so homogeneous. Also not surprising is the all the students identified as being Sequential learners. This again may be a direct result of age.

The Learning Styles Questionnaire (LSQ) developed by Honey and Mumford (1992) identifies four types of learners: Activists, Theorists, Pragmatists, and Reflectors. Students identified largely as Theorists (72%) and to a lesser degree as Reflectors (15%). This may be the result of their level of learning—this was a sophomore class and students at this level are not required nor have they developed skills in group dynamics and intuitive decision-making. Honey and Mumford indicate that individuals tend to rely on one of these approaches when they are engaged in learning. This seems to hold true here.

Eachus' (1993) Academic Self-Efficacy Scale assesses the extent to which students believe they have the ability to exert control over their academic environment. Students' scores were all across the board here, some being very high and others relatively low. There does not seem to be a pattern with respect to gender or course section. The small sample size may be a deciding factor and a larger sample size is needed to better understand the implications of self-efficacy.

Thus, from this preliminary analysis we find that there are some scales that seem to better predict learning outcome than others. Solomon and Felder's (1996) Index of Learning Styles (ILS) seems to have more consistent and applicable predictive value than the other scales. Kolb's (1984) Learning Style Inventory also seems to shed some light on which learning style is more prevalent in distance learning. The results of this pilot study suggest that a larger sample might be useful in determining whether or not these scales do indeed predict learning outcomes. Correlation with students' final grades might be even more of a significant factor. A follow-up study will be done to determine the effects of grade on learning style.

IMPLICATIONS FOR EDUCATORS

Given the sheer number of students who anticipate taking or are currently taking distance-learning courses, the need to be able to quickly and easily assess their potential level of success in these courses is paramount. Simply because it is an available alternative to the traditional classroom does not make it a viable option for everyone. Students have specialized needs and skills and not every student may be suited to a distance-learning environment. It is the responsibility of educators to make sure that students know and understand the risks and potential drawbacks to this environment. The last thing we want is for a student to be "lost in cyberspace" when a simple assessment early on might have identified the student as a poor candidate for distance learning. Regardless of the attractiveness and profitability of this new pedagogy, we must still be available for our students and provide them with every opportunity to further their education as they go forward on their journey in today's fast paced digital world.

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WHAT MAKES DISTRIBUTED LEARNING EFFECTIVE?

Panel

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DESCRIPTION

Technological advances in hardware, software and networks have made it possible to move the contents of a course completely on-line and new tools such as threaded discussion groups, chat rooms, and virtual lectures allow professors to conduct a class entirely on line. These new tools are available from a number of commercial providers and are necessary for the development and management of a distance-learning course.

Effective use of distance learning technologies in the classroom can transform the learning process. The use of higher-order skills such as problem solving, collaboration, statistical analysis and simulation enhances student learning. Assigned projects require greater student initiative and enable them to incorporate "real world" scenarios to supplement traditional learning. Current distributed learning tools provide instructors with powerful tools to monitor, guide and assess the progress of their students as well as the ability to bring subject matter experts into the classroom virtually. Thus, these learning information systems can be used to track student performance in real time and over time. Instructors can also use distributed learning tools to access resources to supplement instruction and exchange ideas with other instructors and professional experts in their domain. Such learning tools have the potential to become not only an "instructors aide" in the classroom, but a complete learning information system. Characteristics of effective distributed learning include:

- High Expectations
- Effective Instructors
- Technology in every students hand

- Engaging and interactive high quality content
- Internet connection
- Adequate learning time

A pre-requisite to a successful course in a distributed learning mode is content that sets high expectations from students through effective delivery of challenging subject matter in a manner that is motivating to students. It is also important to carry content on user-friendly platforms that utilize multimedia tools that students tend to be attracted to. Finally, instructors delivering course content must be able to effectively use the technologies. This might require them to modify or shift their pedagogical paradigm and behavior. The myriad benefits of integrating distributed learning technologies into the classroom when successful include:

- Student Motivation
- Student Achievement
- Higher level thinking
- Gives instructors tools to improve instruction
- Utilizes resources of the WWW
- Expands learning time
- Prepares students for the digital world

Our experiences in developing distance-learning courses date back to as far as 1996. As early adopters of the Internet and World Wide Web (WWW) in our traditional on-campus classes, it seemed to be a logical and natural extension of what we were already doing. Much of our course material was already on-line and accessible through our course pages or through Blackboard™, eCollege™, WebCT™ or some other provider. Many of us had detailed web pages and external links to other resources on-line and students were quite pleased with the amount of supplemental information provided to them. Our shared dilemma was our uncertainty of how to duplicate the "classroom environment" in an on-line setting and how students would respond to the lack of face-to-face, personal contact typical of an on-campus course.

PANEL FORMAT

The members of this panel will share their experiences with distance learning and focus on the challenges they face and how they have solved/attempted to solve these challenges. Focus will be on what each of us has found to be most effective in teaching in a distance-learning environment. Each member will share their own experiences and then the panel members will field questions from the audience.

ALPHA IOTA MU: IMPLEMENTING AN INFORMATION SYSTEMS HONOR SOCIETY

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ABSTRACT

Honor societies provide a valuable function in service to professional associations and provide important benefits to members. Alpha Iota Mu, under the auspices of the International Academy for Information Management, was formed as the honor society for information systems students and professionals. In this paper, we describe how an institution can form a chapter of Alpha Iota Mu.

THE ROLE OF HONOR SOCIETIES

Honor societies have long been established, particularly in American academic culture, as a means of promoting high standards in a specific discipline and as a means to honor those who are especially deserving. The Association of College Honor Societies (ACHS), founded in 1925, is the nation's only certifying agency for college and university honor societies. Currently, the ACHS certifies 65 honor societies. One of those societies is Upsilon Pi Epsilon, the national scholastic honorary society for students of computer sciences. However, there is no corresponding honor society for students of information systems. The authors' goal is to establish Alpha Iota Mu as the certified honor society for information systems.

THE HISTORY OF ALPHA IOTA MU

Alpha Iota Mu was founded under the auspices of the International Academy of Information Management (IAIM). In 1996, President Sheila Pechinski and the Board of Directors of IAIM authorized Indiana State University to found the Alpha chapter of AIM.

The first induction was held at Indiana State in May 1997. Sixteen students, four faculty, and one alumnus were honored. Spring induction ceremonies have been conducted since that time. In 1999, Johns Hopkins University became the Beta Chapter, and Southern Alabama the Gamma Chapter. Georgia Southern came aboard in 2000 as the Delta Chapter. Currently, four schools are in the initial stage of forming chapters—George Washington, University of Tampa, Marymount, and Delta State.

Since its inception, the stated purpose of Alpha Iota Mu is to foster academic excellence, to promote high ethical standards among information systems professionals, and to encourage the growth of the profession.

BENEFITS OF MEMBERSHIP

All honor societies confer benefits to their membership. Foremost among these benefits is the lifetime recognition provided by membership. As time passes and the prestige of the society grows, employers increasingly realize the value of members' academic achievements. Membership can also assist in advancing the career opportunities of members. As members graduate and assume important positions in the business community, they provide excellent sources of help and guidance for future employment. The opportunity Alpha Iota Mu student and alumni members to network with business professionals can provide members with a significant advantage in competition for employment.

Ultimately, Alpha Iota Mu plans to provide other services, including annual newsletters, leadership forums, on-line learning facilities, and scholarships. As Alpha Iota Mu matures, we will be able to provide on-line community services similar to those provided by Beta Gamma Sigma (Beta Gamma Sigma, 2001), which includes members-only features that add value to the BGS lifetime membership. These features range from free web space, to email address and forwarding, to searchable on-line directory, to message boards and on-line chat rooms. Beta Gamma Sigma's site allows members to participate in timely and thought-provoking polls and surveys on current business topics.

STARTING A CHAPTER

The purpose of this paper is not only to inform educators about Alpha Iota Mu and not only to encourage the formation of chapters but also to provide specific details about starting a chapter. While fully realizing the advantages of installing a local chapter, many dedicated academics are wary of the commitment of their time and their energy to the installation and maintenance of a local honor society.

The authors are dedicated to the principle / of streamlining the acceptance procedure, providing guidelines which minimize the time and effort required to institute a local chapter. We have learned from our previous experience and our improving our process.

Faculty who are interested in starting a local chapter should visit the Alpha Iota Mu website at http://alphaiotamu.org/. Brent Bacon, president of the local chapter and Webmaster, deployed the website in September, 2001. The website includes instructions for forming a chapter. The first step is to form a committee—interested faculty, students, alumni, community leaders, business or IS advisory boards—all can make valuable contributions and suggestions. However, it is our recommendation that the sponsor appoint a small steering committee to make the few key decisions that have to be made—requirements for induction, e.g. At Indiana State, the committee which formed the Alpha Chapter consisted of one faculty advisor and three academically gifted students. Our MIS Advisory Board also offered input and advice. The steering committee should draft local chapter by-laws and submit them to the international governing board at sdbuff@befac.indstate.edu for approval. To assist local chapter in the drafting of by-laws, we provide a template—the by-laws which have been adopted for use at Indiana State. Because each institution is to some degree unique, it is expected that each chapter's by-laws will differ to reflect those unique features. For example, there will always be minimum academic and character standards required for induction. Those standards can vary from school to school, so long as they are approved by the governing body. Once the chapter by-laws have been approved, or approved as amended, the chapter is authorized to conduct induction ceremonies.

There is a $50 fee for chartering the local chapter. The local chapter will then be provided with a chapter charter and the oath of induction. In order to conduct the initial ceremony, a member in good standing should administer the oath. The governing body can assist in the induction of the initial member.

The governing body can provide you with other guidelines, too. The governing body can provide templates for scripting the induction ceremony, audio pronunciation of the Greek symbols, guidelines for speakers, etc. Pins bearing the Alpha Iota Mu logo and certificates for individual members are available for $18 each, plus $15 shipping and handling.

SUMMARY

We believe that forming a chapter of Alpha Iota Mu, the honor society for students of information systems, performs a valuable function to the profession and to the members. We have formulated a procedure to minimize the expenditure of time and energy in chapter formation. We encourage all interested individuals to contact us to initiate chapter formation. We believe the intrinsic rewards alone are worth the costs.

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COMPARING BUSINESS AND GAME PROJECTS FOR INTERMEDIATE PROGRAMMING CLASSES

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ABSTRACT

In many MIS or business computing programs, students are ready to take on larger projects in intermediate programming classes. These classes are often taken before students are exposed to databases, systems analysis and design, and user interface design. As a result, even simple business projects can be difficult to manage.

One alternative is to have the students build simple games. Games encourage experimentation with animation, sound, and other special effects. At the same time, more typical requirements can still be included such as file input and output, standard algorithms (sorts and searches), and reports (game summaries). More importantly, games can be more fun to build than typical business projects. This should increase the amount of time spent on the project, and thus students should learn more. Game projects should also encourage creativity and experimentation.

This study compared 25 game and 22 business projects written in Visual Basic under similar conditions. The game projects observed in this study turned out to be almost twice as large and more than twice as complex as the business projects, using common software size metrics. This suggests that students are spending more time writing them and presumably learning more.

INTRODUCTION

In many MIS or business computing programs, students are ready to take on larger projects in the second or third programming classes. These classes are often taken early in their programs, so students have only limited exposure to databases, systems analysis and design, and user interface design. As a result, these students can have difficulty managing even relatively simple business projects.

One alternative that addresses some of these concerns is to have the students build simple games. Dobing and Erbach (1999) noted that such projects offer "clear goals, room for creativity (particularly in the user interface), and scalability (partial implementations are still playable). Games encourage experimentation with simple animation, sound, and other special effects. But at the same time, game project requirements can still include more traditional features such as file input and output (e.g., game logs and saving), standard algorithms (sorts and searches), and reports (game summaries). The paper concludes with the following claim.

> While we cannot quantify the results, we believe that students spent more time on the game projects than they would have with traditional projects, exhibited greater creativity, and experimented more with aspects not taught in class (particularly Visual Basic controls). Thus, we believe they probably learned more and that is after all the primary goal of the

project and the class (Dobing & Erbach, 1999, p.302).

This study provides some empirical evidence to partially support these claims. The game projects observed in this study turned out to be almost twice as large and more than twice as complex as the business projects, using common software size metrics. However, there was no evidence of greater experimentation with controls and events in the game projects. Creativity is difficult to define in this context and was not included in the study.

Perhaps the most interesting issue is determining how the effectiveness of different assignment types should be assessed. Instructors commonly grade assignments against each other and against some expected standard to arrive at a quality measure (grade). But what criteria should be applied when comparing different assignments to determine their relative effectiveness at helping students achieve their learning goals? Conventional software metrics are suggested as a useful and relatively simple measure for this purpose.

RESEARCH HYPOTHESES

Based on the educational literature, we expected students would spend more time on game projects. While we could have asked students to log the time spent on their projects, the reliability of such self-reported measures seems low based on anecdotal reports from students involved in previous studies that used this method. Thus, we instead chose to study the size of the output rather than the effort:

H1: Students working on game projects will write larger and more complex programs.

Because students were expected to spend more time on game projects, we also expected they would experiment more with different features of the language. Visual Basic has a large library of controls (with associated events). There is both a basic toolbox of controls that is normally displayed on the screen when a new project is opened, plus an extensive additional set that can be added. These additional controls have their own associated events. Greater experimentation should mean that:

H2: Students working on game projects will use a wider variety of interface controls and events.

Ideally, we would like to test a third hypothesis, that students who work on game projects learn more and produce projects of higher quality. Both of these are very difficult to measure, with software quality perhaps being the best evidence of learning. Software quality is most commonly measured through user satisfaction and defect counts (Jones 1991, p.22). Grades are similar to a satisfaction measure, but are obviously subject to bias (particularly across different projects) and reliability concerns. Using multiple graders could improve reliability, but the resources required would be considerable. Quality must also consider the complexity of the task. Which has greater merit, a highly simplified game that works well or a more complex one with some defects? Can the code used to move Monopoly pieces be meaningfully compared to code used to slot courses into a program or select an automobile for purchase? These questions are not easily answered.

Defects could include run-time errors, inaccurate responses, and missing features and all are normally reflected in the grades. But there are problems measuring them in a reliable and unbiased way. Run-time errors are observable, but often depend on the order of the events (which, in games, can be random). Errors can also prevent testing subsequent code (unless fixed by the instructor). Accuracy can be verified, but different types of projects offer quite different levels of difficulty. Identifying missing features and crediting extra ones also becomes more complicated when students are encouraged to add variations to games or other tasks, as was done in this study.

Maintainability is another dimension of quality, and within that, adherence to coding standards would be the easiest aspect to measure. However, coding standards changed with the textbook used, different Microsoft recommendations and instructor preferences during the experimental period. Other measures of maintainability, including module cohesion and coupling, are even more difficult to apply.

Because of these difficulties, the only currently available measure of quality is the grade assigned by the instructor. Further research to identify better approaches would be welcome.

EXPERIMENTAL DESIGN

The experiment was run at a smaller university (about 6,000 students) that offers separate Computing Science and MIS programs. All MIS students must take the introductory Computer Science course, which was taught in Pascal, Java or C++ over the course of this experiment. Neither Visual Basic, nor any other variety of Basic, was ever used for that course or any other Computer Science course. The MIS program offers its own required course in Visual Basic, which was used for this experiment.

Some of the Visual Basic students have more programming courses and experience than just the Computer Science prerequisite mentioned. The MIS program has a second required programming course that was taught in either C++ or Java during the period of the experiment. This course emphasizes object-oriented programming while the Visual Basic course focuses on the visual programming environment. The courses can be taken in either order. Some students also have related work experience, either through the University's Coop program or jobs they find on their own. However, only a few students had ever worked with Visual Basic previously and none had the equivalent of an introductory course.

There are also a few Computer Science students who take the course each term. Some are doing combined MIS/Computer Science degrees. These students have been included in the study. There have also been four graduates who have taken the course, either as part of their ongoing job training or towards a graduate degree. Projects done by these students, always done individually or with another graduate, have been excluded from the analysis.

The same instructor taught all Visual Basic classes offered in the MIS program during the experimental period. The course content and the students were reasonably consistent from term to term. The instructor first taught Visual Basic (Version 5) in fall 1998 as a special elective course using Zak (1998) as the text. Because the fall 1998 term was the first VB course taught, the software was a different version, larger team sizes were permitted, and students could choose their own projects, the results are not included in the analysis. Based on positive student response, the course was added to the MIS program requirements. While the software was changed to VB 6 in spring 1999, the textbook remained the same and course was still essentially taught as VB 5. By fall 1999, a Visual Basic 6 textbook was adopted (Bradley & Millspaugh, 1999) and used through Spring 2001. The full Professional Versions of Visual Basic were available in the labs for all classes, and students also had access to the more limited versions that accompany both textbooks. The class is taught in a lab where every student has a computer, with an enrollment limit of 23. One class was taught in each term except for spring 2001, when demand was sufficient to offer two sections. Each class completed four smaller assignments (worth 5% each) before beginning their projects. The project was worth 30 or 35% of the final grade for each of the six classes taught over five terms.

In all classes used in this study, students chose their own partners. Only two-person teams were permitted to control the "free rider problem. Some chose not to have a partner, could not find a partner, or were abandoned by their partner part way through the project. There were only a few single-person projects and they tended to be smaller, so they are not included in the analysis.

Each term, students were asked to suggest projects and then vote for their preference. There is no apparent reason why students switched from preferring games to business projects in Fall 2000. Some students in both Fall 2000 and Spring 2001 were disappointed because they had taken the course with a game project in mind. The change was not imposed to create data for this study. The professor actually encouraged selection of a game project in Fall 2000 and was surprised by the vote. Nor is there any obvious reason to explain why more students chose to work individually on the business projects. Students are told that all projects are graded equally, regardless of whether there are one or two programmers. Table 1 summarizes the projects used and numbers of teams (e.g., spring 1999 had 9 two-person and 2 one-person projects).

TABLE 1
PROJECTS AND TEAMS

Term	No. of Projects	Project Type
Spring 1999	9 (2), 2 (1)	Monopoly
Fall 1999	9 (2), 0 (1)	Trivial Pursuit
Spring 2000	9 (2), 1 (1)	Yahtzee
Fall 2000	5 (2), 4 (1)	Automobile Dealer Vehicle Purchase
Spring 2001	17 (2), 5 (1)	MIS Student Program Planner

The Monopoly, Trivial Pursuit and Yahtzee projects required conversion of the standard board games to a computerized format. Students were encouraged to customize the formats. For example, two Monopoly games used local street names and another was based on local bars. The Yahtzee project offered less opportunity for customization, although there were both Sesame Street and Spice Girls versions. The Trivial Pursuit game was based on a school class, with questions built around the student's favorite sports, foods, songs, etc. The program could then generate random multiple-choice questions, e.g., "What was Chris Smith's favorite song? The incorrect answers came from other students' responses.

One disadvantage of game projects is that there are often Visual Basic versions (complete with source code) available on the Internet. There were apparently no VB Monopoly versions available when that project was used. In contrast, several version of Yahtzee could easily be found. To limit their usefulness, some additional requirements were imposed that were not met by the Internet versions. Similarly, some Trivial Pursuit games are available but the required version was quite different and most students created their own board layout.

The first business project, the automobile dealer vehicle purchase system, was based on the VB Auto Center case in Bradley and Millspaugh (1999). Students had some advantage with this project because earlier assignments had been based on this case. For all other classes, the projects did not build on previous assignments. Moreover, the textbook provided considerable help in suggesting features and interface designs so students had a reasonably clear objective. This helped compensate for some of the disadvantages of business projects noted in the Introduction.

The most recent "business project was an MIS Student Program Planner. The purpose was to help college transfer MIS students (the simplest type to handle) plan their two years of courses in the business school. While no interface design was suggested, the project should have been easier for students to relate to than most business projects because they are the intended users. Courses taken are similar for all students and program planning is an exercise they have all been through.

MEASUREMENT

Program size and complexity were measured using three common approaches. The first is lines of code (LOC). LOC (or KLOC, thousands lines of code) has been frequently used to measure programmer productivity (e.g., KLOC per year), such as in the COCOMO model (Boehm, 1981) and subsequent variations. There are different definitions of what constitutes a LOC. Some include all lines; others exclude variable declarations and comments. We defined Lines Of Instructions (LOI) to include all executable statements, but exclude comments, blank lines, declarations, and With statements (but not the statements inside the With group). Non-Commented Lines Of Code (NCLOC) were defined as any line of program text that is not a comment or blank line, which Fenton (1991) claims is the most common definition. While Visual Basic allows multiple declarations within a single line, and multiple statements separated by colons, this practice was not encouraged by the texts or instructor and was not commonly used. Thus, the lines of variable declarations should be very close to the number of variables. Commented Lines Of Code (CLOC) is NCLOC plus the number of lines of comments. The CLOC measure excludes blank lines and empty comments (which were counted as blank lines). The number of code statements with both code and inline comments was also recorded, but these comments did not affect the CLOC measure. Finally, Total Lines of Code (TLOC), including even blank lines, was also measured.

Statements on more than one line (continuations) could be counted as single or multiple statements. Students were encouraged to use continuations whenever a line was too long to print without "wrapping. The number of continuation lines was recorded so that they could be included in the NCLOC and CLOC measures if desired.

Because continuations within comments can be used in lieu of repeating the comment character, comment continuations were treated as if they were new lines of comments. The same rule was applied to declarations.

Visual Basic Form (.frm) files also include control code generated through the Design mode of the interface. For example, drawing a textbox on a screen will create something similar to the following lines of code:

```
Begin VB.TextBox Text1
      Height      =   285
      Left        =   1680
      TabIndex    =   2
      Text        =   "Text1"
      Top         =   120
      Width       =   735
End
```

Any additional property value changed in Design mode results in another line of code. Adding these statements to the normal LOC measures would seem to overestimate their importance. For the projects included in this study, the average lines of control code (mostly property assignments) were almost three times larger than the NCLOC measure. Ignoring controls does not seem appropriate either; some, such as creating a Toolbar, require considerable time. For this study, separate control and code measures were used.

The number of controls of each type used was counted, along with the number of unique controls (i.e., counting only the first instance of use for each control). The control count included every member of a control array. Menu items were also included as basic controls. However, controls created in code were not counted (and were not seen in any of the students' projects). Unique events were also counted, regardless of what type of control was involved. This is admittedly a limited operationalization of "experimentation. Counting the number of controls or functions used that were not required in assignments, discussed in the textbook, or covered during class might be better, but far more complicated because they vary from term to term. In any event, examples that meet all three criteria would be quite rare.

A second type of measure is code size, measured in bytes. First, a File Size (FS) measure was computed based on the file sizes of all the code modules. Next, Code Size (CS) was measured as the number of bytes in the code statements, excluding all comments and control code. For this measure, all indentation was removed, along with extra spaces within the code. The Commented Code Size (CCS) measure was the same except that comments were included. Unlike LOC measures, size measures are unaffected by whether several statements are placed in one line or one statement is divided over several lines. Size measures have similar shortcomings to LOC measures, plus the additional concern that longer variable names increase the metric but not the coding effort.

The third type of measure attempts to include complexity. The Halstead metric, as described by DeMarco (1982, pp. 269-272), combines length and vocabulary (complexity). Length is the total number of operators and operands (tokens in the code) and vocabulary is the total of unique instances of these tokens. Tokens are extracted using spaces, parentheses, periods, underscores and exclamation marks as separators. The formula is:

$$\text{Volume} = \text{Length} * \text{Log}_2(\text{Vocabulary}) \qquad (1)$$

This metric will be larger if the program is treated as a single piece of code rather than as several modules. For this study, the volume of each file (form or code module) was computed separately and the total was used as the Halstead metric. Comments and Visual Basic control code were not included in the original metric and are therefore excluded here as well. Character strings, either in code or declarations, are treated as a single token regardless of length and internal spacing.

The other complexity measure used was based on McCabe's Cyclomatic Measure. DeMarco (1982, pp. 119-122) provides a simplified version for a module (equivalent to a Visual Basic procedure) that is a count of all decision statements, including loops, plus one. To get a project measure, the count of all decision statements is added to the number of procedures. This is referred to here as the Decision Point (DP) metric. Both the original McCabe measure and the simplified version used here are unaffected by control code, which contains no decision points. A more recent and detailed presentation of the McCabe measure can be found in Watson and McCabe (1996).

All three types of software metrics have been rightly criticized as management tools for several reasons. They are difficult to compare across environments, which may have very different typical code density. They do not accurately reflect the implications of such decisions as the unrolling of loops to squeeze out a little faster performance. In addition, employees who know they are being assessed in this way can manipulate them. They are also less effective as predictors of implementation time and effort; function points are often preferred for that task (Jones, 1991). Nevertheless, as Fenton and Neil (1998) point out, the simple metrics remain in use precisely because "they are easy to understand and simple to collect. They also note that LOC measures are "routinely used and the McCabe metric "remains exceptionally popular.

More importantly, for the purposes of this study, many of the concerns raised do not apply. The students' projects were of comparable complexity, all using the same version of the same language. All students followed the same software standards (as set out in the textbook and classes) and, in a sense, reported to the same manager (course instructor). Projects were judged on quality, not on their size. Indeed, the students did not know that the projects would also be measured in this way. Function points vary across individual projects because some teams attempt more complex implementations. Consequently, it is a reasonable expectation that the average size of the code base of these projects is in fact representative of the effort that students put into them.

For all three measures, code in ".bas (standard or code modules), ".cls (class modules) and ".frm files (form modules) was counted. There can also be code inside ActiveX controls (".ctl files), but only one ActiveX control was used in the student programs and that was a copy of a class example (a digital clock, which was irrelevant to the project). Therefore, ActiveX code was not included in the measures. Visual Basic classes were included, but only two projects contained them, so no separate count of this code was made. The code for automatically generated About Forms was excluded from all measures, although it was included when the students apparently generated their own code. (The distinction was based on some of the comments included in the automatically generated code.) Regardless of how it was generated, the About Form was included in the Form count. Finally, the code in the automatically generated Group (.vbg) and Project (.vbp) files was not counted.

A Visual Basic Code Analyzer program was written in Visual Basic to measure both the control and code parameters listed above. The number of Form, Code and Class Modules referenced in the project file were also counted, using code in the .vbp files. Counting the modules referenced is not the same as counting all submitted modules. Some projects contained extra .frm and .bas files not accessible through the project and these were ignored. However, it is possible that some projects contained modules and code that could never be executed. Determining whether a program contains such code is known to be a very difficult problem.

The Code Analyzer assumes that the students' programs can be compiled. Thus, it does not need to deal with code containing syntax errors or other problems that might make statements difficult to classify. For example, code cannot contain key words (e.g., "Do or "If) as variable names and still be compiled. There were a few cases where programs did not meet this criterion, but very few statements (if any) would be miscounted because of it. While the Code Analyzer program would need further work to be applied to more sophisticated Visual Basic code, such as might be written by advanced students or professional programmers, the features provided are sufficient to analyze the code of students in their first or second Visual Basic class.

RESULTS

The analysis is based on projects completed over five terms (six sections) beginning in spring 1999. During that period, undergraduate students submitted 27 two-person game projects and 22 two-person business projects. However, two game projects contained substantial amounts of plagiarized code (one from another group and the other from the Internet). These projects (for which the students received a grade of 0) were excluded from the analysis, leaving 25. The Code Analyzer program was used to compute the measures and SPSS-10 was used for the statistical analysis.

The Code Analyzer provides three types of measures of programming effort. For Lines of Code, six measures can be computed. The LOI, NCLOC, CLOC and TLOC measures were used as defined above and summarized in Table 2. In addition, continuation statements were added into the NCLOC and CLOC measures to create two additional measures. However, correlations between the measures with and without continuation statements exceeded 0.99 so there is no reason to include both. The measures reported in this study exclude continuations (i.e., a statement on more than one line is counted as only one statement).

Table 2 compares the two project types using 12 measures of size and complexity. For all measures, game projects are clearly larger than the business projects. The game projects have almost 80% more lines of code, with or without comments, and 90% more lines of instruction. The code size (in bytes) is slightly more than 80% larger, although file size is only 62% larger (because the control code is more similar in size across the projects). The two complexity metrics show the largest differences, with games being 111% more complex using the Halstead metric and 116% with the Decision Point metric. Thus, the differences are not only statistically significant as noted in Table 2 but are also much larger than had been anticipated. (The t-test significance levels assume that the population variances are not equal. This assumption generally produced slightly weaker significance levels than when equal variances were assumed.) Game projects also had an average of 70% more controls and 57% more control property statements. This is not as large a difference as was found in the code measures, but is still substantial. Thus, the results support hypothesis H1 that students write larger programs for game projects than business-related projects.

Table 3 shows some of the key metrics for each project. Monopoly generated the largest projects, but for every metric the lowest average among the games (usually Trivial Pursuit) exceeds the highest of both business projects (usually the Auto Center). Individual t-test results are not provided because the number of projects in each class is too small for any meaningful analysis.

The correlations among the size measures were very high. Eight of the measures in Table 2 do not include control code. (This excludes File Size and the three Control measures at the end of the table.) Their correlations are shown in Table 4. All are significant at the 0.01 level and even the weakest correlation (0.914 between Commented Code Size and the Lines of Instructions) is still very strong.

There are three pure Control Code measures (number of controls, number of control properties and total lines of control code). The last two are almost the same, so their

TABLE 2
AVERAGE METRIC VALUES

Software Metric	Game	Business	Size Diff	T-Test Sig.
LOI - Lines of Instructions	1,021	537	90%	0.00
NCLOC Non-commented Lines of Code	1,307	729	79%	0.01
CLOC - Commented Lines of Code	1,558	874	78%	0.01
TLOC Total Lines of Code	2,010	1,233	63%	0.02
FS File Size (bytes)	189,815	117,195	62%	0.03
CS Code Size (bytes)	41,108	22,706	81%	0.01
CCS - Commented Code Size (bytes)	52,755	28,835	83%	0.03
Halstead Metric	45,133	21,421	111%	0.00
DP - Decision Points	215	99	117%	0.01
NOC - Number of Controls	314	184	71%	0.02
NOCP - Number of Control Properties	2,775	1,765	57%	0.04
LOCC - Lines of Control Code	3,614	2,316	56%	0.04

TABLE 3
AVERAGE METRIC VALUES BY PROJECT

Metric	Monopoly	Trivial Pursuit	Yahtzee	Auto Center	Program Planner
NCLOC	1,746	948	1,272	834	698
CLOC	2,237	1,079	1,419	1,015	833
CS	60,307	29,426	35,050	25,182	21,978
CCS	85,177	34,872	40,451	33,381	27,498
Halstead	63,021	30,050	44,212	23,200	20,898
DP	310	135	211	85	104
NOC	457	283	204	197	181
NOCP	4,089	2,246	2,054	1,881	1,731

TABLE 4
CORRELATIONS AMONG CODE MEASURES

	LOI	NCLOC	CLOC	TLOC	CS	CCS	Halstead
LOI	1.000						
NCLOC	0.995	1.000					
CLOC	0.964	0.979	1.000				
TLOC	0.962	0.974	0.991	1.000			
CS	0.954	0.956	0.947	0.952	1.000		
CCS	0.914	0.927	0.967	0.962	0.969	1.000	
Halstead	0.979	0.981	0.971	0.965	0.980	0.955	1.000
DP	0.961	0.955	0.933	0.928	0.936	0.906	0.960

correlation of 1.000 is not surprising. The number of controls is also correlated at 0.98 with both these measures. The correlations among three measures that include Control Code (the number of controls, number of control code lines, and total size) and the eight size measures in Table 4 are provided in Table 5. These correlations are not quite as high (generally between 0.70 and 0.80 for pure control code measures and around 0.90 for total size). All correlations in Table 5 are statistically significant at the 0.01 level.

The high convergence of these measures is not surprising. Some are inherently related by the methods used to compute them. However, some of the convergence is no doubt also due to the similarity in projects tasks and student backgrounds. Moreover, coding standards were set by the textbook and enforced by the instructor (beginning with the four prior assignments). Thus, we would not expect these correlations to be as high if they were measured across a sample of different projects from different organizations.

The second hypothesis was that game projects would encourage a greater variety of interface controls. As shown in Table 2, game projects had 70% more controls. However, they used more controls of the same type rather than different controls. As shown in Table 6, both types of projects averaged just over nine different controls. This is slightly less than half of the 20 basic controls available in Visual Basic. While game projects did have the higher average, it is not significant and the difference is too small to be important. For additional controls, business projects had a higher average than the

TABLE 5
CORRELATIONS BETWEEN CODE, CONTROL AND TOTAL SIZE MEASURES

	Controls	Control Code Lines	Total Size
LOI	0.768	0.798	0.909
NCLOC	0.750	0.781	0.904
CLOC	0.709	0.751	0.902
TLOC	0.713	0.748	0.899
CS	0.726	0.751	0.899
CCS	0.676	0.725	0.898
Halstead	0.713	0.749	0.895
DP	0.780	0.821	0.924

TABLE 6
DIFFERENT CONTROLS AND EVENTS

Metric	Game	Business	T-Test Sig.
Different Basic Controls	9.52	9.14	0.51
Different Additional Controls	1.28	2.68	0.01
Different Event Procedures	5.24	5.18	0.92

games. The number of different events (e.g., Click, Change, etc.) was also measured but proved to be virtually identical for the two project types. Thus, hypothesis H2 cannot be supported with the measures used in this study.

Part of the reason that business projects have more additional controls is that all but one used a database. Only a few of the games did. For the Auto Center project, the database had already been set up in a previous assignment. The DAO data control comes from the basic toolbox, but the grids and data bound combo boxes that are often used with it come from the additional project components. A few teams used the ADO control, another additional control. Toolbars, which required two additional controls, were also more common on the business projects.

As discussed earlier, comparing the average quality of projects in one assignment to another is not easy and grades may not be comparable from one assignment to another. In this case, the game projects averaged 78% while the business projects averaged only 69%, significant at the 0.02 level. However, grades are a much more subjective measure and fully controlled by the researcher so this evidence is hardly conclusive. As a general observation, it would seem that the average quality of game projects at least matched and probably slightly exceeded that of the business projects. Thus, the real difference was in the relative sizes.

In general, project grades correlated with software metrics at about 0.60 (all at the 0.01 level), ranging from 0.546 (Halstead) to 0.632 (Commented Lines of Code). Correlations between grades and control measures were about 0.35 (with significance around 0.02). The correlations between grades and software metrics are not perfect due to defects in the code, redundant code (which should have been collapsed into a single function or loop), poor user interface design, failure to adhere to standards, and other factors.

CONCLUSIONS

Based on the projects analyzed in this study, game projects encouraged students to write about 80% more code with more than double the complexity. These results are much stronger than we had expected. Based on student comments, the main reason appears to be that games are more fun to program. They also appear to engender a more competitive spirit among teams. The difference might have been greater had the students not selected business projects that were easily understood.

However, games do not seem to encourage students to use a wider variety of controls or events. Most students relied on a fairly small set of controls that had been covered in class. If this type of experimentation is an important goal of the class, the instructor might need to explicitly encourage their use. For example, all game projects could have required a database. The Monopoly database could record property names and values, players' worth, etc.; the Trivial Pursuit database could hold data for questions and answers, etc.

In future research, we would like to broaden the measures used to include program quality. Tools that would also be helpful in grading would be particularly valuable.

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PROGRAMMING LANGUAGES FOR TEACHING OBJECT-ORIENTATION

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ABSTRACT

The choice of a language for teaching object-oriented programming is difficult. The primary goal should be to develop an understanding of the object-oriented paradigm in students. The language used should strongly support this goal. The problem is that pressures other than this goal often have an impact on the language choice. The objectives of teaching object-oriented programming are developed and two languages, Java and Smalltalk are evaluated with respect to these objectives. The analysis suggests that either language can be an effective teaching tool. However, more care must be taken with the use of Java to enforce the student's understanding of object-orientation.

INTRODUCTION

Object-Oriented Analysis and Design and Object-Oriented Programming are becoming a very important subject in the information systems curriculum. The AIS Model curricula [Davis, et al., 1997] for the information systems major include object-oriented subjects. This paper focuses on object-oriented programming and takes the position that while object-oriented programming is markedly different from third-generation language programming, it also has some significant similarities. For example, students using either type of programming language must understand the core programming concepts of control structures (sequence, selection and iteration) and data storage and use (files and variables). Therefore, teaching object-orientation must have the primary goal of developing a complete understanding of the object-oriented paradigm in the student rather than just learning another programming language.

The choice of programming language to be taught to students should include attainment of this goal as the primary objective. However, the choice is made difficult by forces external to the goal. The "real world" wants schools to teach languages that are relevant. This usually means the language they primarily use in their organizations. Students also want to learn programming skills that are marketable. These forces may put pressure on the institution to teach languages that are less desirable learning tools than they may otherwise choose. Specifically, the issue boils down to choosing between languages used extensively by business such as C++ and Java and languages that are less used but may be better suited as a teaching tool such as Smalltalk. Additionally, the tool used to teach object-orientation may have a significant impact on the level of difficulty learning object-orientation experienced by students [Kolling, 1999].

To better understand how the choice of language impacts on the goals of teaching object-orientation, this paper describes the object-oriented concepts that should be focused on in teaching object-oriented programming. The paper then evaluates two languages (Java and Smalltalk) in terms of how well they support learning these object-oriented concepts.

THE GOALS OF TEACHING OBJECTS

The goal of teaching object-orientation with a programming language should focus on developing the student's understanding of the object-oriented paradigm. Learning programming language syntax and structure is very important to achieving this goal. However, there should be no doubt that it is a secondary goal. Anecdotal evidence suggests that there are many programmers using languages that support object-oriented programming writing programs that do not implement the object-oriented paradigm. This is primarily because they do not understand it. Once a programmer understands the paradigm, language selection can be made on other factors because they can implement a properly designed object-oriented system independent of the language they learned the concepts in. It is merely a matter of learning different syntax (This may not be a trivial matter, but it is less important than the proper implementation of objects).

Developing an understanding of the object-oriented paradigm in students involves three distinct objectives: (1) Developing an understanding of what an object and a class is, (2) Developing an understanding of how objects work together, and (3) Developing an understanding of how to use objects to implement an application. These goals build on one another and a course in object-oriented programming should begin with the first goal and conclude with the last. Each of the goals is developed below.

Object and Class

The first objective in teaching object-oriented programming is to help the student develop an understanding of object and class. Within this overall objective are several important concepts that must be developed. The first concept focuses on the relationship between the real world and the "code world." The thrust of learning is to get the student to understand how real world objects may be abstracted to be represented in program code. This also includes the importance of being able to program systems in such a way that the relationship between the system code and the real world it represents is very clear to individuals involved in developing and using the system. The second concept is focused on developing an understanding of the structure and behavior of an object. Structure is concerned with the data that the object maintains and behavior is concerned with what an object can do. The concepts of object and class are introduced when implementation of the structure and behavior is discussed. Several items of importance are covered: (1) how structure is implemented with variables, (2) how behavior is implemented with methods, and (3) how the class is primarily a definition of an object that gives the programmer the ability to create actual objects that have the ability to maintain the required data and perform the required operations (behavior). The concept of encapsulation is introduced when discussing how only the object's own methods can manipulate its data.

Once the above two concepts have been developed, the student is introduced to the idea of inheritance by determining if the proposed object can reuse previously developed code. Here the student should be taught to examine existing objects to determine if (1) the proposed object is a more specialized version of an already existing object, or (2) if an existing object has much of the desired structure and behavior of the proposed object even though the proposed object is not really a specialization of the existing object. The ability to examine existing object structure and behavior is very important to facilitating the achievement of this objective. All the concepts discussed to this point are developed both theoretically and through example by actually developing the object in some code. The final step is to develop an understanding of how the object, once implemented, is used. Included is a discussion of object creation, message passing, and referencing an object. Again, this discussion should be supplemented with demonstration in code.

Interacting Objects

The second objective in teaching object-oriented programming is to help the student develop an understanding of how objects interact with one another. There are also several important concepts to be developed within this objective. The concepts developed in achieving this goal are highly interrelated. They include message passing as a way for one object to get services from another object, encapsulation, inheritance, and polymorphism. Several objects that work together to perform some task should be developed. The discussion should again include the concept of encapsulation. It is very important to emphasize and demonstrate the fact that one object cannot directly manipulate the data held by another object. Data is exchanged and changed between objects only if the appropriate messages are passed. The student needs to understand that the messages an object responds to are its interface. Polymorphism, the same message producing different responses in different objects, is another important concept focused on in this objective. It is addressed by passing the same message to different objects and showing the results. Inheritance is demonstrated by passing a message to an object that does not directly implement that method. The object's superclass implements the method and still the object responds appropriately.

Object-Oriented Applications

The third objective in teaching object-oriented programming is to help the student develop an understanding of how to use objects to implement an application. The primary concept within this objective is developing an understanding of the Model-View-Controller paradigm for object-oriented applications. The model is the functionality behind the application. Students should understand that this functionality is provided by a set of classes. The view is the interface to the application. This is usually a window or set of windows displayed on the computer screen. Students need to understand how to create the interface controls (for example, text boxes, menus, and buttons). The controller provides the interface between the view and the model. It gives function to the interface. Students should develop an understanding of how the view and model are associated with the controller to complete the application. Throughout this and the previous objective, an understanding that students are not just creating an application, they are also creating the programming language for the application should be developed.

EVALUATION OF OBJECT-ORIENTED TEACHING LANGUAGES

Languages for teaching object-oriented programming should be evaluated on how well the language supports achieving the above three objectives. This evaluation was done by implementing a simple checkbook application Java, and Smalltalk. C++ was not included because it is a hybrid language that supports both object-oriented programming and traditional programming. Kolling [1999] suggests that leads to the development of an understanding that object-orientation is just a language extension rather than a completely different paradigm for programming. The checkbook application involves a checking account that has two types of transactions, deposits and checks. Four classes are required for this application: Account, Transaction, Deposit, and Check. Transaction is the superclass of Deposit and Check. It is used to demonstrate inheritance and reuse. A fifth class, AccountManager is also developed to implement the application interface. An outline of the structure and behavior of each class is identified below.

Transaction Class

Variables:	transactionDate	(date of the transaction)
	amount	(amount of the transaction)
Functions:	set and retrieve the value of transactionDate	
	set and retrieve the value of amount	

Check Class (Transaction subclass)

Variables:	checkNumber	(number of check posted to account)
	payee	(receiver of the check)
Functions:	set and retrieve checkNumber	
	set and retrieve value of payee	
	print the check	

Deposit Class (Transaction subclass)

Variables:	type	(type of deposit eg. cash, check)
Functions:	set and retrieve the value of type	
	print the deposit	

Account Class

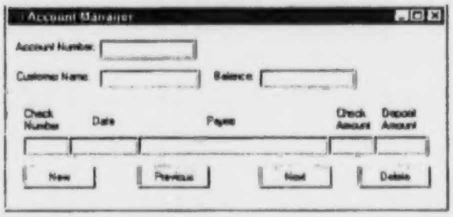
Variables:	accountNumber	(number identifier of the account)
	accountName	(name of account owner)
	balance	(current account balance)
	transactions	(collection of deposits and checks)
Functions:	set and retrieve value of accountNumber	
	set and retrieve value of accountName	
	retrieve value of balance	
	(cannot directly set the value of balance)	
	add a deposit to collection and update balance	
	add a check to collection and update balance	
	delete a deposit from collection and update balance	
	delete a check from collection and update balance	

AccountManager Class

Variables:	currentAccount	(account object displayed on screen)
	currentTransaction	(transaction object displayed on screen)
	transactionNumber	(to track the transaction object displayed on screen)

Functions: update account information from values entered on screen
update transaction information from values entered on screen
move forward one transaction in collection and display on screen
move backward one transaction in collection and display on screen
add a new transaction to account
delete a transaction from account

Interface:



To evaluate the language, the Transaction, Check, and Deposit classes are implemented and tested to evaluate support of the first objective. Second the Account class is used together to demonstrate the functionality of the application and evaluate support for the second objective. Finally support for the third objective is evaluated by creating the AccountManager class.

Developing an Understanding of Object and Class

The differences between Smalltalk and Java are immediately apparent in the implementation of the first class, Transaction. Declaring instance variables in Smalltalk requires no determination of access right or type. All variables can hold any type of object, are inherited by subclasses, and are fully encapsulated by the object. In Java, the developer must determine the type of data that the variable will hold, if the variable can be inherited by a subclass, and what other objects should have access to the variable. Smalltalk has the advantage here. The limited choice selection in creation of object variables supports the learning of object-orientation because all variables in all classes follow the same rules. Additionally, because all variables are what would be considered private access rights in Java, it enforces the concept of encapsulation in the student's mind. Variables are only accessible by providing a method to get at the variable. Method implementation in both languages is similar. One difference is Java's need to type variables and therefore type methods that return values. However, this is not a problem in learning object-orientation. Java's use of access rights for methods can cause some confusion. All methods in Smalltalk can be used by other object's to get an object to perform some action. In Java, the access right again determines who has access to the method. This requires the developer to pay attention to access right during development of the class. Both languages are equally adequate at helping the student understand the difference between a class and an instance of that class (or an object). The instructor may create multiple new instances of the class and demonstrate how each has its own values for each variable.

The Check and Deposit subclasses of Transaction should inherit the transactionDate and amount variables. While both languages allow this to happen, the Smalltalk class browser immediately shows the inheritance of these variables by the subclass. In Java, the variables are not shown in the new class definition. This can make it difficult for the student to understand that the variables are a part of the new class. Polymorphism is equally easy to understand with these classes. Both classes implement a method to print the object with the same name (printOn). It is easy for the student to understand that when a Check object is sent the message printOn it will print a check while when a Deposit object is sent the message printOn it will print a deposit.

Developing an Understanding of How Objects Work Together

Differences between the languages are also apparent when developing the Account class. The Account class holds information about the account and all the Checks and Deposits made against the account. Using these objects in the account object begins to demonstrate how objects work together to accomplish some task. The first difference is the collection to hold Transaction objects (Checks and Deposits). The developer has to import the java.util.Vector class and declare an instance variable to be of type Vector to hold these objects. This is essentially the same thing the student saw when creating a Date data type in the Transaction object. Differences in the implementation of polymorphism become more apparent here. The first difference between the languages is in implementing a method to add a Transaction object to the collection. This method needs to add the transaction and either increment or decrement the account balance depending on whether a Check or Deposit has been added. Java has the advantage because it can use polymorphism in the form of method overloading to implement this functionality. In Smalltalk, the developer has to explicitly determine the type of object being added. This is easiest to see by comparing actual code.

Java

```
public void add(Check c)          //method name
{
    balance=balance – c.amount(); //get check amount
and subtract from balance
    transactions.addElement(c); //add check to collection
}
public void add(Deposit d)        //method name
{
    balance=balance + d.amount(); //get deposit amount
and add to balance
    transactions.addElement(d);//add    deposit    to
collection
}
```

Smalltalk

```
add: aTransaction   "method name"
(aTransaction isCheck)  "determine if object is a Check"
    ifTrue:
        [
            balance = balance - aTransaction amount.
    "get check amount and subtract"
            transactions addLast: aTransaction.
"add check to collection"
        ]
    ifFalse:
        [
            balance = balance + aTransaction amount.
    "get deposit amount and add"
            transactions addLast: aTransaction.
"add deposit to collection"
        ]
```

Two methods are written with the same name in Java. The only difference is the parameter. This makes the code easier to understand for the student because each method applies to only one type of object. The Smalltalk code has the feel of a traditional type checking with one exception that illustrates polymorphism: The message *amount* can be sent to the same variable and it will work properly regardless of the type of object it holds. In Java we must use variables of different types.

In using Java to teach object orientation, it is important to properly protect an object's variables with the selection of the most restrictive access right possible. If the check or deposit classes declared the variable *amount* to have anything other than a private access right the above methods could directly access the value rather than using a method to access it. While the application will work in this manner it violates the object-oriented principle of encapsulation. An object in Smalltalk allows access to its variables only through methods implemented by the object. This forces proper object-oriented programming because the developer cannot create an object that works as a set of global variables.

The second difference is in the implementation of the Account class print method. This method prints account information and a list of all transactions. Smalltalk's implementation of polymorphism is better in this situation. The difference associated with printing of the set of transactions in the account. Again the code will help illustrate these differences. The following code is not complete and has been altered to help illustrate differences in the languages.

Java

```
public String printOn()           //method name
{
// printing of account information not included

//the following code prints the transactions
for (i=1; i <= transactions.size(); i++)
//iterate through the collection
{
    if (transactions.elementAt(i) instanceof Check)
    //test if object is a check
    {
        Check c = (Check) transactions.elementAt(i);
    //convert object to check
        c.printOn();              //print check
    }
    if (transactions.elementAt(i) instanceof Deposit)
    //test if object is a deposit
    {
        Deposit d = (Deposit) transactions.elementAt(i);
    //convert object to deposit
        d.printOn();              //print deposit
    }
}
```

Smalltalk

```
printOn: aStream            "method name"

"printing of account information not included"

"the following code prints the transactions"
transactions do:                "iterate through the
```

collection"
[:aTransaction | aTransaction printOn: aStream].
"print each transaction"

The collections in both languages can hold any type of object. However, because of the strong typing in Java, the collection returns objects held in the collection as type Object. There is no *printOn* method defined in the object class so each object retrieved from the collection must be tested to determine what class of object it is. Once class determination has been made, the object is *downcast*, or converted, into that type of object. Then the printOn method may be used. In Smalltalk, it does not matter what type of object receives the *printOn* message. At run time the object will correctly execute its own printOn method. In this way, Smalltalk more clearly illustrates the concept of polymorphism.

Developing an Understanding of How to Use Objects to Implement an Application

Differences between the languages is minimal when implementing an application using the model-view-controller paradigm. Both languages have an environment for "painting" the interface, or view. Java has an interface that may be more familiar to students than the Smalltalk painter. However both provide the ability to create an interface using the Windows API. The languages are also similar in that they both use one class to implement the view and the controller. The view is a method in the class to create the window with the appropriate controls on it. The interaction between the view and the model is implemented with methods associated with control events (for example, a button click) and references to the model are made through instance variables. The controller has minor differences which support object-orientation in the Smalltalk version. In Smalltalk, all controls are distinct objects whose reference must be passed to each method that uses them in the controller. In Java, the controls are also objects, however, any method in the controller can get access to any object in the view without explicitly passing an object reference. The Smalltalk implementation has a slight advantage in enforcing object-oriented thinking in students.

CONCLUSION

Either language can be used to effectively teach object-oriented programming. However, if the primary goal of the course is teaching objects, then more care must be taken in using Java than in using Smalltalk as the teaching vehicle. Java's multiple access rights may be used improperly to violate the object-oriented principle of encapsulation. Polymorphism also must be planned for more specifically in Java than in Smalltalk. This becomes especially relevant when it cannot be determined prior to runtime what class of objects will be used in a particular program situation. Because of this, the instructor must emphasize the benefits of polymorphism more when using Java. Inheritance also must be carefully planned when using Java. Access rights can restrict the inheritability of variables. In simple objects such as the ones developed for this evaluation, the student may not understand the benefits of inheritance over just creating another class if they constantly have to be aware of how they determine access rights for an object. However, these issues should not keep one from using Java to develop an understanding object-orientation. Only that extra care must be taken in course delivery. Java is a language with better corporate acceptance than Smalltalk and should be considered an appropriate vehicle for teaching objects.

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KNOWLEDGE SHARING TOOLS AND THE FACILITATION OF STUDENT TEAM PERFORMANCE IN IS COURSES

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ABSTRACT

This paper describes a knowledge sharing/management tool that has the potential to enhance student project team performance in IS courses. The tool, which is called I-KSS (Internet Knowledge Sharing System), provides a mechanism for organizing and sharing knowledge gleaned from the Internet among group members and other students enrolled in IS courses. It has the potential to facilitate the completion of student projects that include Internet research while simultaneously teaching users about knowledge management through hands-on exposure to a working knowledge sharing tool.

INTRODUCTION

It is widely recognized that in order to dynamically respond to a changing environment, an organization must do more than process information efficiently. It must also create information and knowledge (Nonaka, 1994). Companies that effectively create and process knowledge can leverage this ability to achieve a competitive strategic advantage.

Student teams in IS courses are often called upon to function as mini-organizations whose success is directly linked to their ability to acquire, manage, share, and process knowledge. This is especially true when student teams are challenged to assemble, filter, evaluate and synthesize research on IS topics in order to develop group deliverables on emerging technologies and other IS topics. The information and knowledge management challenges faced by student teams are amplified when group assignments require the acquisition and synthesis of information and knowledge from the Internet's vast pool of resources.

Increasingly, information systems educators are requiring student teams to complete group assignments that involve Internet-based research and/or require student-to-student collaborative interaction via the Internet (e.g., Bialaszewski, Case, and Wood, 1996; Buffington & Wood, 1997; Chimi and Gordon, 1997). IS educators often use such assignments to illustrate the challenges of information and knowledge sharing via the Internet. These types of assignments also serve to provide students with first-hand insights into distributed collaboration (Munkvold and Line, 2000) and virtual team coordination and management (Sarker, Lau, and Sahay, 2000).

Numerous researchers have recognized long-term benefits of instructional approaches designed to help students learn to be effective contributors to team projects (e.g., Alavi, Wheeler, and Valacich, 1995; Fellers, 1996; Van

Slyke, Trimmer, and Kittner, 1997). Other researchers have illustrated the value of employing groupware (e.g., de Vreede, Briggs, and Santanen, 1999), computer supported collaborative learning (CSCL) mechanisms/tools (e.g., Brandon and Hollings-head, 1999; McConnell, 1994; Seufert and Seufert, 1998) and computer support for distributed collaborative learning (CSdCL) (Fjuk, 1998) as tools for facilitating collaborative learning and team-based information/knowledge creation and sharing.

Dun and Hackney (2000) argue that it is time to move traditional approaches for facilitating collaborative learning among team members. They suggest that student exposure to student-oriented intranets and other knowledge sharing tools should be incorporated into IS curricula. Their rationale derives from mounting evidence that knowledge management concepts must mastered by students to survive in contemporary businesses that increasingly demand continual learning (DeGues, 1997). These arguments are also bolstered by an investigation conducted by Endlar (2000) demonstrating that intranets can be effectively leveraged to support team learning. They are also supported by the burgeoning body of research indicating that knowledge sharing is a key aspect of knowledge management processes in today's organizations.

The rationale underlying the framework on which I-KSS is based is outlined in the following section. Subsequent sections describe a conceptual framework for Internet knowledge capture, storage, and sharing and a description of a software application derived from the conceptual framework: I-KSS. Then, the paper presents potential uses of I-KSS in IS courses.

KNOWLEDGE SHARING IN TODAY'S ORGANIZATION

Numerous studies have explored how organizations create, store, and disseminate knowledge (e.g., Grant, 1996; Kogut and Zander, 1992; Teece, Pisano, and Shuen, 1997). Knowledge in organizations is generated through collaboration, interaction, and relations among groups or units. The knowledge is stored and integrated to form *organizational knowledge*, such as competence, capability, or routines that can be used for creating and sustaining competitive advantages. Similar knowledge management activities are required of student teams in IS courses. Like groups/teams in business organizations, student teams are unlikely to fully realize the benefits of the information/knowledge that they acquire through completing group assignments unless the knowledge is effectively shared.

Knowledge sharing has been identified in many studies as a key knowledge management challenge (e.g., Duffy, 2001; Dyer and Nobeoka, 2000, Gupta and Govindarajan, 2000). To address knowledge sharing challenges, a number of organizations including Chevron, Xerox, Johnson & Johnson, Ford, and Whirlpool, have encouraged the creation of knowledge-intensive cultures that promote knowledge sharing (Stepanek and Brown, 2000).

Increasingly, organizations are tapping the vast pool of information resources available on the Internet for information/knowledge creation and sharing. The Internet has grown to encompass diverse information resources including trade publications, product and service catalogs, and government information. Many organizations including General Electric, IBM, Merrill Lynch, and Xerox, are leveraging the Internet's vast pool of information for strategic planning (Pawar and Sharda, 1997). The Internet is also being used to capture information about competitors, including company profiles and industry analyses, that is subsequently shared, published, stored and leveraged for strategic decision processes (Leibs, 1998).

Information technology is widely recognized as an important enabler of knowledge acquisition and dissemination (Hansen, Nohria, and Tierney, 1999). Other studies suggest that Internet tools, such as e-mail, search and retrieval tools, and information repositories, are potential facilitators of knowledge sharing and integration within organizations (e.g., Alavi and Leidner, 1999; O'Leary, 1998).

I-KSS:
AN INTERNET
KNOWLEDGE SHARING SYSTEM

The Internet Knowledge Sharing System (I-KSS) leverages the Internet and information technologies, such e-mail and knowledge repositories, to facilitate sharing information among the members of groups within organizations. The tool itself derived from a conceptual framework that can be traced back to fundamental knowledge management concepts.

Nonaka (1994) has identified two types of knowledge: *tacit* and *explicit*. *Tacit* knowledge is personal knowledge embedded in individual experience. *Explicit* knowledge is formal knowledge that can be found in an organization's documents. Unlike tacit knowledge, explicit knowledge is relatively easy to transfer and share. Organizational knowledge can be created through processes that integrate and leverage tacit and explicit knowledge. Alavi and Leidner (1999) define knowledge management as a systematic, organizationally specified process for acquiring, organizing, and communicating the organization's explicit knowledge and the tacit knowledge of employees in ways that enable others to be more effective and productive.

The knowledge management process involves three major sets of knowledge activities: knowledge generation, codification, and utilization (e.g., Alavi, 2000; Davenport and Prusak, 1998). Organizational knowledge is generated through collaboration, interactions, and relations among groups or units. Organizations codify knowledge into accessible and applicable formats for reuse (Davenport and Prusak, 1998). The codification of tacit knowledge presents special challenges to knowledge managers (Hansen et al., 1999). As noted by Alavi (2000), knowledge generation and codification are only beneficial in organizations that are also effective in knowledge utilization (the sharing, integration, and application of the specialized knowledge of their employees).

Several studies have indicated that knowledge sharing can contribute to competitive strategic advantage (e.g., McEvily, Das, and McCabe, 2000; Teece, 1998). These studies indicate that effective knowledge sharing enables organizations to improve efficiency, reduce training cost, and reduce risks due to uncertainty.

Several investigators have proposed alternative ways to promote knowledge sharing within organizations (e.g., Gupta and Govindarajan, 2000; Hansen et al., 1999; Lei, Slocum, and Pitts, 1999). They suggest that knowledge sharing can be enhanced by:

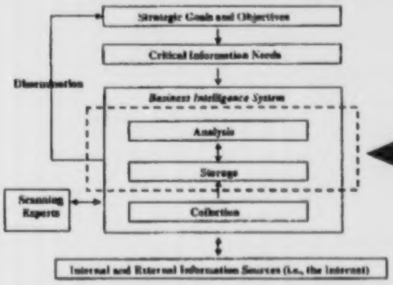
- *Using rewards or incentives*: Employees in organizations often have little incentive to share their own knowledge and insights with others (Lei et al., 1999). In such instances, it may be necessary to motivate their willingness to share through the use of explicit rewards or incentives. Establishing an appropriate knowledge sharing reward/incentive structure can also help organizations create knowledge sharing cultures.
- *Using effective processes to codify knowledge*: It is recognized that tacit knowledge cannot be easily codified due to the nature of this type of knowledge. Explicit knowledge less challenging to codified and store in files and documents (Hansen et al., 1999). Because the ease with which decision makers can access and leverage codified knowledge is an important determinant of the utilization and effectiveness of a knowledge management system, it is important to ensure that the organization's explicit knowledge is appropriately codified.
- *Using different sharing mechanisms for explicit and tacit knowledge*: Document exchange is highly efficient and effective to share codified knowledge, whereas personal contact is likely to be more effective for sharing tacit knowledge (Gupta and Govindarajan, 2000).
- *Using groupware to facilitate communication among team members:* Groupware has often been viewed as have the potential to promote knowledge sharing by capturing knowledge and enabling communication across groups or units. However, groupware's limitations, including technical complexity and poor connections with Internet-based tools, restrict groupware's potential to facilitate knowledge creation and sharing within organizations (Dennis, Pootheri, and Natarajan, 1998).
- *Leveraging data warehouses for knowledge management:* Data warehousing has also been recognized as having numerous knowledge sharing benefits including making accurate information available to decision makers and providing better access to information. Davenport, De Long, and Beers (1998), for example, emphasize the significance of knowledge repositories in knowledge management initiatives and note the key role that they may play in promoting knowledge access, and knowledge sharing.
- *Using the Internet to expand the organization's explicit knowledge:* The Internet's vast pool of information resources is being increasingly used by organizations to support information and knowledge creation and sharing. Little research attention, however, has been given to managing information (especially

unstructured information) obtained from the Internet or to the organizational processes for enhancing and sharing Internet knowledge.

AN INTERNET KNOWLEDGE SHARING SYSTEM FRAMEWORK

Figure 1 presents a framework for enhancing and sharing information and knowledge derived from the Internet. This framework is based on Choo's framework (1995) for a business intelligence system.

FIGURE 1
FRAMEWORK FOR AN INTERNET KNOWLEDGE SHARING SYSTEM

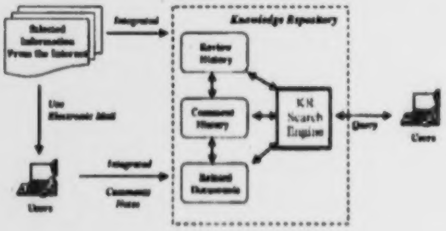

Strategic Goals and Objectives
Critical Information Needs
Dissemination
Business Intelligence System
Analysis
Storage
Collection
Scanning Experts
Focus of I-KSS
Internal and External Information Sources (i.e., the Internet)

The framework illustrated in Figure 1 assumes that organizations first determine a set of critical information needs based on their strategic objectives. Critical information needs vary across organizations as a function of differences among the nature and importance of their particular strategic objectives. Within an organization, the critical information needs associated with a particular strategic objective can be operationalized as a list of all relevant information categories and types that are valuable for that strategic objective. Once critical information needs for the organization's strategic objectives have been identified, scanning experts are better positioned to conduct the following scanning activities.

- *Collection*: information is gathered from external sources by using Internet tools including conventional World Wide Web search engines (e.g., Yahoo), and traditional on-line databases (e.g., LEXIS-NEXIS). Scanning experts may also be able to leverage Web browsers and search engines to scan Web-enabled internal databases and knowledge repositories.
- *Analysis*: collected information is compared, collated, and interpreted by using scanning experts' domain knowledge. One direct result of analysis is the immediate transfer of mission-critical or time-specific information to senior managers via electronic mail, instant messaging, or other communication technologies.
- *Storage*: information that has been analyzed and determined by scanning experts to be relevant is filed and indexed into the knowledge repository through the use of *add* and *update* algorithms and information retrieval techniques. Domain experts can also use *purge* algorithms to ensure that the content of the knowledge repository does not include out-of-date information and/or information that has little relevance to the organization's strategic objectives.

The Internet Knowledge Sharing System (I-KSS) is derived from the conceptual framework illustrated in Figure 1. I-KSS, which is depicted in Figure 2, focuses on *analysis* and *storage* activities after users have identified relevant information from the Internet. It also addresses the sharing of relevant Internet-based information and knowledge.

FIGURE 2
OVERVIEW OF I-KSS'S KNOWLEDGE SHARING PROCESS


Selected Information From the Internet
Integrated
Knowledge Repository
Review History
Comment History
Related Documents
KN Search Engine
Query
Users
Use Electronic Mail
Users
Integrated
Comment Notes

I-KSS Consists of Three Major Processes

- Integrating relevant information with the knowledge repository,
- Sending E-mail to specific decision makers if newly collected and analyzed information has been identified as mission-critical, and

- Organizing the knowledge repository to facilitate knowledge sharing.

Each of these is briefly described below.

Integrating Internet Information with the Knowledge Repository

Once scanning experts have identified relevant information from the Internet, the information is integrated with the knowledge repository by using the three key operations: *Add*, *Update*, and *Purge*. These operations use distinctive keywords extracted from the information to determine the knowledge integration strategy. For keyword extraction, information retrieval techniques are used: *stop list* to eliminate common words (e.g., the, and, of, etc.) and *stemming* to identify the root of a word by removing or modifying prefixes and suffixes (Korfhage, 1997).

In the *Add* and *Update* operations, in order to compare selected information with the existing information, I-KSS checks the elements (i.e., keywords) of *Source*, *Subject*, *Date*, and *Content*, in turn. Before adding Internet information to the knowledge repository, I-KSS first examines whether identical information exists in the knowledge repository by checking the *Source*. If *Source* is the same, *Subject* is examined next. If *Subject* is the same, I-KSS next inspects *Date*. Only when *Date* of the newly acquired and analyzed information is more recent than that of existing information in the knowledge repository, I-KSS adds the new information to the repository. In the *Add* and *Update* operations, I-KSS contains several actions.

- *Add the document*: to save the selected information into the knowledge repository.

- *Update the document*: to replace the existing information with the selected information.

- *Ignore the document*: to purge the selected information. I-KSS observes that both the existing information in the knowledge repository and the selected information are identical because they have the same elements of *Source* and *Subject*. Then, I-KSS keeps the existing document.

The *Purge* operation allows I-KSS or the user to maintain the knowledge repository more efficiently. Through the *Purge* operation, I-KSS is able to keep a set of information that matches the user's current interests and reduces redundancy. I-KSS periodically examines the knowledge repository to keep information relevant to the users. If the saved information is not reviewed during a certain period, I-KSS moves the information from the knowledge repository to a temporary archive.

Sending E-Mail

I-KSS enables scanning experts to immediately send newly acquired information that is identified as mission-critical or time-specific to key decision makers (e.g., senior managers or experts) along with a reference link to the information. Senior managers or experts may provide their own opinions or comments about the new information and send their comments back to the scanning experts. I-KSS enables these comments to be included in the knowledge repository by binding them with the newly added information. I-KSS allows its users to browse *comment* information through a comment history interface, similar to an electronic bulletin board.

Organizing the Knowledge Repository

I-KSS provides several other interfaces that enable users to access the knowledge repository. The knowledge repository supports four major interfaces: *search engine*, *review history*, *comment history*, and *related documents*.

- The *KB search engine* allows the user to search for the information available in the knowledge repository by using a list of *significant keywords* that indicate the nature of stored information contents. The search results include the relevancy rankings, sources, subjects, and partial contents of the information.

- *Review history* provides the capability to browse the review history of specific information, for example, when the information was collected and analyzed, other users who have accessed/used the information, and which significant keywords were used to access the information.

- Comment history provides the history of the comments of senior managers or experts about the specific piece of information stored in the knowledge repository. These include the date the comments were made, who provided the comments, and the detailed contents of the comments.

- *Related Documents* provides a list of other related information in the knowledge repository that is related to a specific piece of information. The similarity between information pieces is measured in terms of significant keywords.

If the users (e.g., senior managers) have interests in a certain topic, they can use the KR search engine to retrieve the related information by selecting a single or multiple significant keywords available in the knowledge repository. The system allows the users to navigate among the interfaces through either the search results or a list of the existing information.

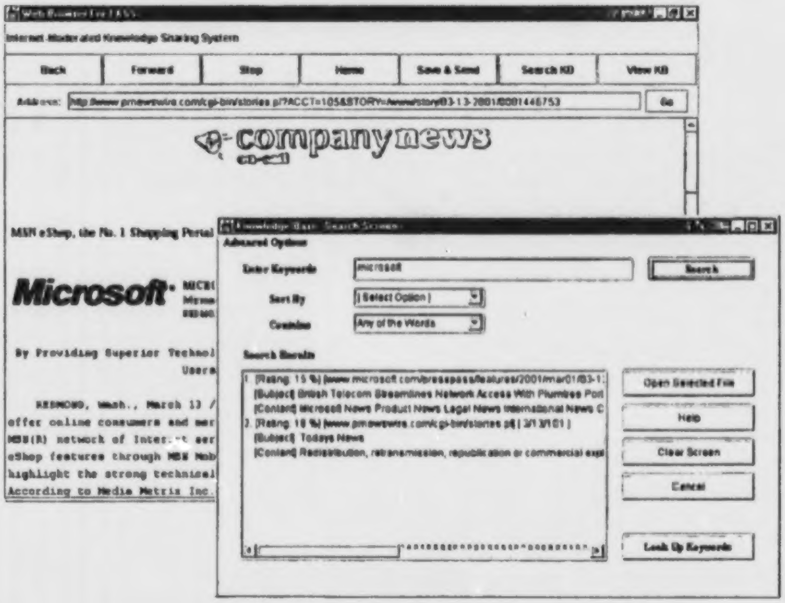
I-KSS IMPLEMENTATION

I-KSS has been implemented in Java using JDK1.3® as a development tool and MS Access® as a knowledge repository. Figure 3 presents examples of I-KSS interfaces.

The main interface has the same major capabilities as Web browsers such as Netscape® or IE®. Like any Web browser, I-KSS allows the user to navigate different Web sites through hyperlinks and to browse previously visited Web pages. The main interface also includes several buttons to allow users to access the knowledge repository and send e-mail. For example, if the user clicks the 'Save & Send' button after the information is identified as relevant, I-KSS stores the information into the knowledge repository and displays an interface for sending the information as an e-mail attachment.

The KR search interface allows users to retrieve information from the knowledge repository by using a single or multiple keywords. Available keywords are listed in a *look-up table* that the user is able to access by selecting the 'Look Up Keywords' button. The look-up table has been arranged in the ascending order of distinct keywords. The search results consist of *source*, *date*, *subject*, *contents*, and *relevancy rating*. In addition, the interface supports Boolean searches. For example, once the user selects "bank"and "online" as keywords and chooses the 'Any of the Words' option, the interface displays a list of all of relevant documents containing either "bank" or "online". With the 'Sort By' option, the retrieved information can be arranged by source or date in ascending order. The system also allows the user to explore the content of the document by selecting the "Open Selected File" button.

FIGURE 3
EXAMPLES OF I-KSS INTERFACES



Address: http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=105&STORY=/www/story/03-13-2001/0001446753

Enter Keywords: microsoft

Sort By: [Select Option]

Combine: Any of the Words

By Providing Superior Technol
Users

REDMOND, Wash., March 13 /
offer online consumers and mer
MSN(R) network of Inter:.-t ser
eShop features through MSN Mob
highlight the strong technical
According to Media Metrix Inc.

1. [Rating: 15 %] [www.microsoft.com/presspass/features/2001/mar01/03-1
[Subject] British Telecom Streamlines Network Access With Plumbee Port
[Content] Microsoft News Product News Legal News International News C
2. [Rating: 18 %] [www.prnewswire.com/cgi-bin/stories.pl] [3/13/01]
[Subject] Todays News
[Content] Redistribution, retransmission, republication or commercial exp

I-KSS also allows users to navigate among the related knowledge repository components: for example, once the user selects the information from the search results and then chooses one of the *Advanced Options*, such as comment history, review history, or related documents, he/she is able to explore the selected option window.

POTENTIAL USES OF I-KSS IN IS COURSES

I-KSS possesses characteristics that enable it to be usefully employed by student teams in IS courses. Because it was created to be compliant with widely accepted GUI standards, the system is user friendly and can be learned quickly. Minimal training is needed to teach student team members to integrate newly acquired information from the Internet into the knowledge repository. Students can also easily master I-KSS's "Save and Send" features to alert fellow team members (or the class as a whole) that they should review the new assignment-relevant information that has been added to the I-KSS knowledge repository. The interfaces for supporting student queries and knowledge repository navigation are also easily mastered. Because of the user-friendly nature of I-KSS, the ability of student groups to assemble, synthesize, and leverage Internet information sources needed to develop group deliverables is enhanced.

I-KSS has the potential to be beneficial to student teams in a wide variety of IS courses. It may be leveraged in upper level IS course that include assignments which require student teams to perform Internet-based research. This tool could be used in upper division MIS courses, MBA-level MIS courses, information resource management (IRM) courses, data communication courses, data management courses, and of course, knowledge management courses. Because I-KSS can support teams whose members are geographically distributed as well as those that are concentrated in a single geographical location, it has the potential to add-value to both distance education and traditional classes. Table 1 summarizes potential uses of I-KSS in various IS courses.

Perhaps the most valuable outcome of allowing student teams to leverage I-KSS is the tool's ability to provide insights about key knowledge management concepts during the process of completing assignments requiring Internet-based research. For example, in general MIS courses and IRM courses, I-KSS can be introduced early in the academic term as a tool to facilitate the assembly of a repository of Internet-based information and knowledge sources that will be needed to complete group deliverables on assigned topics. When attention is turned toward knowledge management concepts later in the course, student experience with I-KSS can be leveraged to illustrate the implementation of key knowledge management concepts. Because of their hands-on experience with I-KSS, students are likely to have a richer understanding and appreciation of knowledge management processes.

TABLE 1
EXAMPLES OF POTENTIAL USES OF I-KSS IN IS COURSES

IS Course(s)	*Potential I-KSS Application(s)*
General MIS course (undergraduate or graduate)	To assemble, filter, share, leverage Internet-based articles and information sources related to emerging technologies, e-business models or technologies, etc.
Data Communications	To illustrate intranets as well as Internet-oriented information and knowledge acquisition and sharing processes; to facilitate the completion of network design and implementation projects that demand students teams to assemble relevant product and cost information from Internet sources.
Information Resource Management	To illustrate the implementation of knowledge management and knowledge sharing processes; to facilitate the completion of students projects that leverage the Internet to identify appropriate measures for evaluating the effectiveness of specific information technologies.
Data Management	To illustrate the mechanics of knowledge repository creation, updating, maintenance, and use; to provide insights into text-based data repositories and search capabilities.
Knowledge Management	To provide hands-on experience with a working information and knowledge creation, sharing, and utilization system.

CONCLUSIONS AND IMPLICATIONS

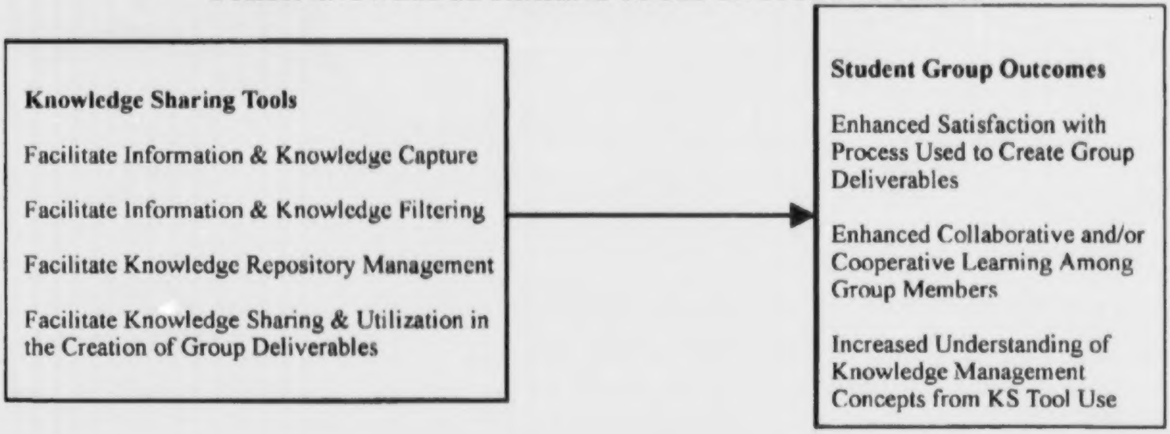
I-KSS is an application that demonstrates the potential to leverage Internet information in knowledge management and knowledge sharing processes. In organizational settings, it enables newly acquired strategically relevant information to be added to a knowledge repository and to automatically alert key decision makers of knowledge repository updates. I-KSS can play an important role in an organization's environmental scanning process that is crucial for identifying external opportunities and threats, implementing strategic changes, and achieving organizational alignment.

I-KSS also illustrates that commonly available communications applications (such as electronic mail) can be adapted to enhance knowledge sharing within organizations. I-KSS and the conceptual model on which it is based have the potential to facilitate theoretical and empirical investigations focused on the design of knowledge sharing systems that are capable of incorporating and leveraging information derived from the Internet. For MIS professionals, I-KSS suggests practical guidelines for leveraging information technologies to collect, analyze, store, and share Internet-based information.

In academic settings, I-KSS has the potential to be used as a tool group-oriented information and knowledge acquisition, filtering, synthesis, and sharing tool. Its user-friendly features enable it to be effectively leveraged by student teams in a wide variety of IS courses to develop a repository of assignment-relevant information from Internet sources. A group member who identifies what he/she considers to be "new" information on Web sites, he/she can leverage the filtering capabilities included in I-KSS's "Add" and "Update" repository management features to ensure that the information has not already been added to the knowledge repository. The group member can subsequently take advantage of e-mail capabilities to let the other members of the team know they should review the new assignment relevant information that he/she has added to the knowledge repository.

As a result of using I-KSS, student team members may find the process needed to develop group deliverables easier and more satisfying/enjoyable. The collaborative/cooperative learning experience associated with developing group deliverables may also be enhanced through knowledge sharing tools such as I-KSS. Through the use of such tools, student team members gain firsthand insights into knowledge management processes and the potential utility of intranets. Figure 4 summarizes some of the potential impacts of knowledge sharing tools on student teams in IS courses.

FIGURE 4
POTENTIAL IMPACTS OF I-KSS AND
OTHER KNOWLEDGE SHARING TOOLS ON STUDENT TEAMS


Knowledge Sharing Tools
Facilitate Information & Knowledge Capture
Facilitate Information & Knowledge Filtering
Facilitate Knowledge Repository Management
Facilitate Knowledge Sharing & Utilization in the Creation of Group Deliverables
Student Group Outcomes
Enhanced Satisfaction with Process Used to Create Group Deliverables
Enhanced Collaborative and/or Cooperative Learning Among Group Members
Increased Understanding of Knowledge Management Concepts from KS Tool Use

Exposure to student-centered intranets and other knowledge management/sharing tools in IS courses has been encouraged by Dun and Hackney (2000) in response to the increasing importance of knowledge management processes within today's organizations. Demand for knowledge sharing tools such as I-KSS is also fueled by the increasing prevalence of group assignments in IS courses that involve Internet-based research. I-KSS arguably provides a more coherent and effective environment for the assembly of and sharing of information sources required by such assignments than many of the approaches that student teams have traditionally used. While other tools such as groupware, computer supported collaborative learning (CSCL) tools and computer support for distributed collaborative learning (CSdCL) tools approaches may be effectively substituted for knowledge sharing tools to facilitate collaborative learning and team-based information/ knowledge creation and sharing, I-KSS and other knowledge sharing tools are better positioned to help students master key knowledge management concepts as they work through the process of developing group deliverables.

FUTURE RESEARCH

I-KSS's potential to support student teams and facilitate student mastery of knowledge management concepts must be tested. During Fall Semester 2001 student teams in a data communications course will be required to use I-KSS during the completion of a network design project. The network design assignment requires each student team to design two alternative LANs for a particular workspace within a specific organization and to use the Internet to identify the hardware, software, and communication media costs associated with each of the LANs they design. Cabling, server, hub/switch, and network operating system costs products, vendors, and prices must be identified. The assignment also requires the student teams to use the Internet to identify current the prices of backup systems and internetworking technologies, such as bridges, routers, and superhubs. Design drawings and cost information is summarized for each LAN is included in a paper that recommends a particular configuration for the organization. Pertinent information from Internet sources on the total cost of ownership, advantages and disadvantages of the recommended LAN configuration must also be included in the team project deliverable. Student teams will be introduced to I-KSS via a one-hour training session. They will also be required to complete a mini-exercise to introduce them to how this knowledge-sharing tool can be used to assemble/share the information needed to complete the network design project. At the conclusion of the project, each student will be asked to answer the questions included in Appendix A. The survey captures student reactions to I-KSS interfaces and student eagerness to use I-KSS to complete future group assignments. Most importantly, the survey prompts students to respond to items that assess whether I-KSS facilitated group information sharing and communication and whether the tool promotes understanding of knowledge management processes.

An additional experiment is planned for Spring Semester 2002 to assess the performance of I-KSS. Student teams in one section of a data communications course will be required to use I-KSS to complete a group network design project similar to that outlined above. Student teams in a second data communications section will be required to complete the same network design project without the assistance of I-KSS. The quantity, quality and utility of the information collected by groups in both sections will be assessed in order to determine if I-KSS adds value to group deliverables. Students in both sections will also be asked to complete a questionnaire concerning group processes leading up to the submission of the group deliverable (e.g., how easy it was to assemble and share assignment-relevant information; quantity and frequency of communication among group members, etc.) Students who use I-KSS will be asked to complete the student reaction survey in Appendix A.

Student feedback about I-KSS's interfaces and functionality will be used to improve the I-KSS configuration. Once configuration refinements are complete, the ability of this knowledge sharing tool to enhance the performance of teams in business organizations will also be tested.

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APPENDIX A
I-KSS REACTION SURVEY

Select the response option that best describes your personal assessment of I-KSS.

1) I-KSS helped my group assemble and share assignment-relevant information.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

2) I-KSS is easy to learn and use.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

3) Adding new information to the I-KSS knowledge repository is difficult.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

4) The e-mail component in I-KSS makes it easy to let classmates know that new information has been added to knowledge repository.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

5) I would like to use I-KSS for future group assignments in other courses.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

6) The user interfaces in I-KSS are easy to understand and use.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

7) I-KSS helps me understand how knowledge is captured, shared, and managed in organizations.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

8) I-KSS's KB Search Engine makes it easy to identify important information in the knowledge repository.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

9) The Comment History, Review History, and Related Documents components are useful features of I-KSS.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

10) I feel that I-KSS increased assignment-relevant information sharing and communication among the members of my group.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

11) I will encourage groups in other courses to use I-KSS to collect, manage, and share information from the Internet.
Strongly agree 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 Strongly Disagree

12) Use the space below to specify how I-KSS should be changed/improved.

DEMOGRAPHIC INFORMATION:

Gender:
[ ] Male
[ ] Female

Age: ______

Education:
[ ] Some High School
[ ] High School Graduate
[ ] Some College/University
[ ] College/University Graduate
[ ] Some Post Graduate Work
[ ] Post Graduate Degree

Major:
[ ] Information Systems
[ ] Information Technology
[ ] Computer Science
[ ] Computer Engineering
[ ] Other (please specify): ____________________

Computer Knowledge:
[ ] No Knowledge
[ ] Some Knowledge
[ ] Reasonable Knowledge
[ ] Very Knowledgeable
[ ] Expert

Frequency of computer use:
[ ] Do not use computers
[ ] Less than once per week
[ ] Multiple times per week
[ ] Daily, < 1 hr/day
[ ] Daily, 1-3 hrs/day
[ ] Daily, > 3 hrs/day

Internet Knowledge:
[ ] No Knowledge
[ ] Some Knowledge
[ ] Reasonable Knowledge
[ ] Very Knowledgeable
[ ] Expert

Frequency of Internet use:
[ ] Do not use the Internet
[ ] Less than once per week
[ ] Multiple times per week
[ ] Daily, < 1 hr/day
[ ] Daily, 1-3 hrs/day
[ ] Daily, > 3 hrs/day

How long have you been using computers:
[ ] < 1 year
[ ] 1-2 years
[ ] 3-5 years
[ ] 6-10 years
[ ] 11-15 years
[ ] > 15 years

How long have you been using the Internet and WWW:
[ ] < 1 year
[ ] 1-2 years
[ ] 3-5 years
[ ] 6-10 years
[ ] 11-15 years
[ ] > 15 years

Please indicate your uses of the Internet and their frequency:

	Do NOT use	Less than Weekly	Multiple Times/ Week	Daily	Multiple Times/ Day
E-mail	[1]	[2]	[3]	[4]	[5]
Instant messaging	[1]	[2]	[3]	[4]	[5]
Chat-room participation	[1]	[2]	[3]	[4]	[5]
Internet voice communications	[1]	[2]	[3]	[4]	[5]
Entertainment (games, music, movies, etc.)	[1]	[2]	[3]	[4]	[5]
Shopping for consumer goods (without purchasing)	[1]	[2]	[3]	[4]	[5]
Purchasing consumer goods on-line	[1]	[2]	[3]	[4]	[5]
Travel Information (airline, car rental, hotel, etc.)	[1]	[2]	[3]	[4]	[5]
Travel Reservations/Bookings	[1]	[2]	[3]	[4]	[5]
Information (news, weather, sports, etc.)	[1]	[2]	[3]	[4]	[5]
Investment and financial information	[1]	[2]	[3]	[4]	[5]
Banking on-line	[1]	[2]	[3]	[4]	[5]
Education	[1]	[2]	[3]	[4]	[5]
Research (business or academic)	[1]	[2]	[3]	[4]	[5]

A COMMITTEE-BASED MODEL FOR SUPPORTING ORGANIZATIONAL KNOWLEDGE MANAGEMENT

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ABSTRACT

Organizations are looking at ways to manage their information resources. Both the capture and the use of data created by the organization have come under scrutiny. Part of the concern comes from their desire to enhance the business process and part comes from the explosion of data available to any organization. In this context the role of committees is being examined both as consumers and producers of information. The present work looks at making corporate knowledge more useful to organizations by focusing on supporting committees. We focus on presenting our knowledge model and briefly look at the prototypes used to test the feasibility of our model.

INTRODUCTION

Knowledge is rapidly becoming a key organizational resource and determinant of organizational performance and competitiveness. Knowledge is the currency of wealth. Knowledge arises out of best practices, traditions, cultures, and other information. Knowledge can be classified into several forms, for example, tactile, syntactic, semantic, and strategic. Whatever the form of knowledge a firm has, unless it is managed properly, there can be no benefit or strategic advantage. Consequently, knowledge management is a process that organizations employ to improve performance. Knowledge management, however, is best described as a concept that explains how information is transformed into actionable knowledge and made available to users. Knowledge management enables businesses to avoid repeating past mistakes, to assure the reuse of best practices, and draw on the collective wisdom of its employees past and present. Knowledge management thus relies on gathering, organizing, refining, and disseminating information and knowledge. Knowledge is often embedded in an organization in the form of experiences or memory. This embedded knowledge has traditionally been known as organizational memory.

Recent developments in information processing technologies have enhanced our abilities for building knowledge management systems. Knowledge is determined through searching, filtering, cataloging, and linking of information collected from a variety of sources and media. Information is refined in multiple ways and disseminated to recipients as reports, analyses, etc.

A knowledge management system must systematically deal with the creation, integration, maintenance, and dissemination and use of all kinds of knowledge within an organization. We have developed a committee-based model comprising several components to manage this process. We see such a model as defining a portal from the organization to its knowledge. The strength of an enterprise information portal lies in its ability to organize disparate information in a seamless fashion. Specifically, the model automates identification and distribution of relevant content, provides content sensitivity, interacts intelligently with users letting them profile, filter, and categorize, and avails of the complex information infrastructure. Central to the system is the user, often a decision-maker or a decision making body of people (as in the case of a committee or group). The components of the model are (1) a recorder subsystem, (2) a composer and builder subsystem, (3) a knowledge navigator and retriever subsystem, and (4) a knowledge percolator subsystem. The model operates on the organizational memory of the organization. While many vendors sell products meeting one or more of the features described above, the lack of ability to apply many of these and other related technologies to complex knowledge such as that contained in prior decisions (including the decision making process) and other forms of organizational knowledge is a problem. In this paper we present the model and briefly look at the prototypes used to evaluate the feasibility of our knowledge management model.

In the next section we briefly look at the issues of developing and using organizational memory. In Section 3 we define and describe our committee-based model. Section 4 looks at the current status of our prototypes for testing the feasibility of the model. Section 5 concludes the paper.

ORGANIZATIONAL MEMORY

Organizational memory has been described to refer to corporate knowledge that represents prior experiences and is saved and shared by users. It may be used to support decision making in multiple task and multiple user environments. The concept encompasses technical, functional, and social aspects of the work, the worker, and the workplace [Durstewitz 1994]. Organizational memory includes stored records (e.g., corporate manuals, databases, filing systems, etc.) [Ackerman 1996] and tacit knowledge (e.g., experience, intuition, beliefs) [Nonaka and Takeuchi 1995]. Walsh and Ungson [Walsh and Ungson 1991] refer to organizational memory as stored information from an organization's history that can be brought to bear on present decisions. By their definition, organizational memory provides information that reduces transaction costs, contributes to effective and efficient decision-making, and is a basis for power within organizations. Researchers and practitioners recognize organizational memory as an important factor in the success of an organization's operations and its responsiveness to the changes and challenges of its environment (e.g., [Angus et. al 1998; Bright et. al 1992; Huber 1991; Huber et. al 1998; Stein 1995; Stein and Zwass 1995]).

Information technologies (IT) contribute to the possibility of automated organizational knowledge management systems in two ways, either by making recorded knowledge retrievable or by making individuals with knowledge accessible [Ackerman 1996]. An organization's knowledge, explicitly dispersed through a variety of retention facilities (e.g., network servers, distributed databases, intranets, etc.) can make the knowledge more accessible to its members. Stein and Zwass [1995] suggest that an extensive record of processes ("through what sequence of events?"), rationale ("why?"), context ("under what circumstances?"), and outcomes ("how well did it work?") can be maintained with the help of IT. The availability of advanced information technologies increases the communicating and decision making options for potential users.

An organizational memory supported by information technology provides several advantages The contents that are stored in information systems are explicit, can be modified promptly, shared as necessary, and changes can be propagated quickly and easily. Information systems should be however be designed to augment the interaction between knowledge seekers and information providers as it would lead to higher levels of organizational effectiveness and learning [Huber et. al 1998]. Technological changes and shifting demands make rapid learning essential in organizations. The advent and increasingly wide utilization of wide area network tools such as the Internet and World Wide Web provide access to greater and richer sources of information. Local area networks and intranets give organizations a way to store and access organization specific memory and knowledge. Used effectively, these tools support the notion of organizational memory.

Sandoe et. al [1998] use Giddens' definition [1984] of organizational memory to distinguish among three types of memory, namely discursive, practical and reflexive. Discursive memory is a collection of stories, anecdotes, reports, and other public accounts. Practical memory is the unarticulated know-how—the skills and practices that comprise the bulk of routine interactivity. Memory that is automatically invoked in organizations without any requirements for conscious thought or discussion such as organizational norms is considered reflexive. Sandoe et al. [1998] argues that there is a continuum of characteristics that stretches between discursive memory on one end and reflexive memory on the other. Discursive memories are oriented to be flexible while reflexive memories are focused on yielding efficient memory use. Organizations have to balance the need for flexibility against the need for efficiency.

Sandoe et al. [1998] treat IT based organizational memory as discursive. They argue that although IT-based memory operates at a discursive level, IT makes the discursive process of remembering more efficient by reducing the costs and effort associated with storage of and access to an organization's memory. IT changes the balancing point in the trade-off between efficiency and flexibility, permitting organizations to be relatively more efficient for a given level of flexibility. Another advantage of IT-based memory is the opportunity to provide a historical narrative (or rationale) for significant organizational events that would otherwise be remembered in non-discursive form. Reliance on IT-based memory, on the other hand, allows an organization to act in a rational manner through the discursive access to its major historical events and transformations.

Organizational Memory Systems (OMS)

Mandiwalla et al. [1998] define an organizational memory system (OMS) to include a DBMS, a database that can represent more than transactional data, and an application than runs on top of the DBMS. They further describe the generic requirements of an OMS to include different types of memory, including how to represent, capture, and use organizational memory. The data shown below lists these requirements.

OMS Design Issues

Designing the ideal OMS is a difficult task, especially as definitions, technologies, and usage contexts continue to shift and evolve. Mandiwalla et al. [1998] identified some of the barriers and issues facing designers.

- Focus: Reconciling group, inter, and intra organizational perspectives of OM.

- Quantity: Balancing comprehensiveness with storage constraints. Incorporating video data quickly tilts the balance away from comprehensiveness. Increasing comprehensiveness also increases the potential for information overload.

- Filters: If you cannot store everything then who decides what to store? What is the mechanism and criteria? How do you avoid bias?

- Role of individual memories: Where do individually held memories fit in? Are they redundant? How can they be used? What are the legal and social implications?

- Storage: OM typically implies some type of storage. Information storage will in the foreseeable future always involve costs such as the actual storage medium, the time needed to access the selected medium, and the administrative cost of maintaining the information. Organizations will need tools that that will help them evaluate the cost benefit of storing memory. For example, 1 second of video (30 frames) needs about 27K of space. This means that about 3 hours of video could be stored on a 10-Gigabyte medium. It is unlikely that storage costs will decrease sufficiently in the near term for this to be a non-issue.

- Retrieval: Widely held assumptions about data imply that the more OM we store the harder it becomes to locate a specific memory item of interest. Therefore, OM conceptual models will need a built in filtering mechanism.

Types of memory	Meta data Structured data (records) Semistructured data (documents) Unstructured data (audio/video) Temporal data
Types of representation	Structure and internal organization of data the representation of data in the user interface
Capture schemes	Transparent versus assisted Hidden versus open
Use	Time and Space considerations Activity driven Coordination needs Boundaries including security

- Integration/Re-integration: If information about the same topic is stored in multiple formats—say in database and multimedia format, users will need to tools to re-integrate or "re-understand" and synchronize the memory.

In the next section we look at a knowledge management system that uses the concepts from organizational memory and applies them to the committee level.

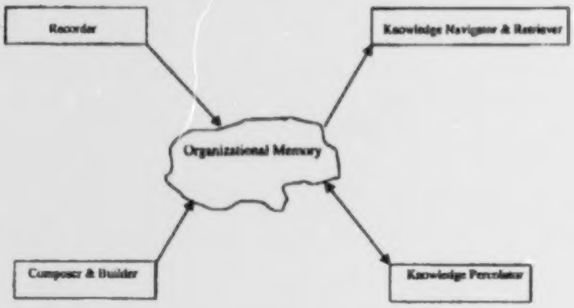
COMMITTEE-BASED KNOWLEDGE MANAGEMENT MODEL

A knowledge management system must systematically deal with the creation, integration, maintenance, and dissemination and use of all kinds of knowledge within an organization. We have developed a committee-based knowledge management model comprised of several components to manage this process. The strength of our committee-based model lies in its ability to organize disparate information in a seamless fashion. Specifically, the model automates identification and distribution of relevant content, provides content sensitivity, interacts intelligently with users letting them profile, filter, and categorize the complex information infrastructure. Central to the system is the user, often a decision-maker or a decision making body of people (as in the case of a committee or group). The components of the committee-based model are (1) a recorder subsystem, (2) a composer and builder subsystem, (3) a knowledge navigator and retriever subsystem, and (4) a knowledge percolator subsystem. A block diagram of the relationship between organizational memory and the components of the model is shown in Figure 1. The data comprising the organizational memory provides the basis of any knowledge extraction. In the remainder of this section we examine the main components of the model.

Recorder

Organizational processes such as meetings, sequences of tasks, operating procedures and policies, etc., are potential sources of knowledge. Recording or capturing a knowledge production process is the first step towards making knowledge available for future use. Capturing the decision making process, as in the case of capturing a focus group meeting, allows for further analysis of the process. Similarly, recordings of events in a process environment (e.g., software development or system maintenance) can be used to maintain examples of best practices.

FIGURE 1
RELATIONSHIP BETWEEN COMPONENTS AND ORGANIZATIONAL MEMORY



A recorder is a tool for capturing the knowledge generation process. Since our model is committee based, we see the recorder as capturing committee meetings. There are numerous formats for the recorder. As support software improves (e.g., dictation software), the range of possibilities will continue to expand. In today's environment the possibilities depend on the media used to conduct the meeting. If the media is the Internet or conferencing software, then a record of the meeting can be obtained by storing the electronic form of the transmissions. For traditional meetings, it is possible to record the entire committee meeting using meeting capture software [Miller and Nilakanta 1997]. You can capture the complete meeting script, including sound, images, and documents that are part of the meeting (decision making) context. Once the recording is complete, the data is prepared for playback. Preparation includes eliminating errors, replacing missing data, synchronizing the sound with the flow of events, and adding security tags. A recorder is a valuable complement to any collaborative tasks.

Composer and Builder

Organizational knowledge ranges from structured data (as provided by on-line transaction processing systems-OLTP) to unstructured data such as user comments, email messages, reports, images, etc. The majority of the structured knowledge in an organization resides in its data warehouses and production databases. Proponents of decision support technologies have focused on not only retrieving information from vast databases, but also in identifying relationships among the different information sets. Only recently has this vision started to take shape. Data warehouses and data mining are fast becoming the knowledge sirens of the nineties.

Designing and building a data warehouse has been an expensive and error prone process. It does not have to be that way. Today, the designer must have intimate knowledge of the database schema to generate a valid data warehouse. With rapid turnover of technical professionals, organizations have difficulty in satisfying this goal today. While more complete meta-data (information about the data) could help, a lack of industry standards is also a major hurdle. The fact that commercial warehouses are value based (record-oriented) and much of the most valuable organizational data is unstructured also limits the value of today's warehouses in the knowledge management process. Object-oriented data warehouses [Miller et. al 1997, 1998] will help bridge this gap, but much work still needs to be done.

Another large amount of data (especially things like reports, email and web pages) may not belong in the data warehouse environment. Supporting these data types requires additional design criteria beyond the development of a module to create data warehouse designs.

Warehouse composer. Research in the database domain has developed several models and algorithms that are useful for designing data warehouses with little intervention of a data warehouse expert required. The warehouse composer uses meta-data to guide the designer to construct any desired warehouse table. The data warehouse composer is responsible for advising the user if a feasible warehouse solution is possible, warning if none exists. The issue is to test the queries required to generate the warehouse table for the lossless join property. Failure to test for the lossless join property could result in creating warehouse tables with erroneous data relationships. Warehouse sources can be single databases or multiple, heterogeneous data sources (relational DBMS like Oracle, SQL Server, flat file systems like VSAM, or any other type of legacy system). When the data sources are many and varied, the warehouse modeler must be able to integrate the semantics of the data sources and bridge the distributed nature of the environment.

Warehouse builder. The warehouse builder is a sub-component that automatically populates the composed data warehouse design. It must be able to automatically populate the warehouse with data extracted from multiple, distributed data sources once the warehouse composer has generated the design of the warehouse table.

Additional data sources. While the recorder is the source of much of the company's internal data, other data, such as email and additional reports, also need to be captured. External data (e.g., reports, web pages) are also part of any company's knowledge base and must be either collected or made accessible by users.

Knowledge Navigator and Retriever

Two subsystems are needed in our model to provide access to both forms of data. First, we need a knowledge navigator to allow users to navigate through the recorded committee meetings. Second, a retriever subsystem is necessary to retrieve information from the organizational memory that does not require navigating a committee meeting.

Knowledge navigator. Navigation through a corporation's knowledge base is a critical component of any knowledge management environment. In our committee-based approach it is necessary that the users be able to look at all or part of any meeting (depending on the security clearance of the user). The committee knowledge navigator is a playback subsystem allowing for selective replay of the meeting or other knowledge creation processes. Selections can be made on the basis of keywords, participants, or other parameters of choice. Unlike other screen-capture movies, the knowledge navigator must give the user increased flexibility in choosing portions of the process to view or learn. Moreover, it must be possible for key parts of the process to be isolated (based on rankings, keywords or security levels) and studied.

Knowledge retriever. As an organization builds its knowledge base using both structured and unstructured data, on line knowledge management systems capable of providing this knowledge to users is needed. Typically, some form of universal query environment that can work with any type of data is needed. These systems can be built around proven technologies such as relational and object database management systems, data warehouses, distributed objects (CORBA), and intelligent agents.

Retrieving information from standard data warehouses or transaction systems is a trivial process. But, when the information is complex (email messages, documents, etc.) and it is widely distributed (internal and external to the organization), simple retrieval schemes will generate millions of pieces of information. Not only is the sheer volume of information retrieved a problem, the relevancy of the retrieved information is also questionable. Unless the retrieval tool can filter out unwanted and irrelevant information and suggest a relevancy index the tool will be of little use.

To support the data that are not directly tied to an individual committee meeting, it is necessary to provide one or more interfaces that give the user access. Today it is very likely that multiple interfaces would be used e.g., an interface that gives access to an existing data warehouse or production database and an interface that gives the user access to textual data. In the future as multidatabase systems [Bright et. al 1992] mature a single interface to several heterogeneous data sources is likely to reduce the need for multiple user interfaces.

Knowledge Percolator

Benefits accrue to organizations when their members can learn from prior experiences. Learning from best practices and experiences requires that the user has easy access to relevant information, can ascertain causes and effects, and derive generalizations. Building a web of antecedents and consequences creates the collective memory of organization.

The knowledge percolator is a software suite that enables the percolation of "wisdom" from prior experiences. Several learning algorithms (e.g., genetic algorithms, pattern recognition, etc.) would be used depending on the task's context to glean the underlying decision process or workflow.

IMPLEMENTATION OF THE COMMITTEE-BASED MODEL

To test the feasibility of the model presented in the previous section, we implemented prototypes of the components of the model. A block diagram of a typical problem domain is shown in Figure 2. The remainder of this section briefly looks at some of the key features of our prototypes.

Recorder

To capture meetings, we have implemented acknowledge recorder designed to capture individual committee meetings [Miller and Nilakanta 1997]. The capture phase starts at the meeting. The sounds of the meeting are captured in a .wav file. In addition to the captured sound, the recorder generates a command file and captures any on-line images that have been presented at the meeting. A block diagram of the process is shown in Figure 3.

FIGURE 2
BLOCK DIAGRAM OF A
TYPICAL PROBLEM DOMAIN

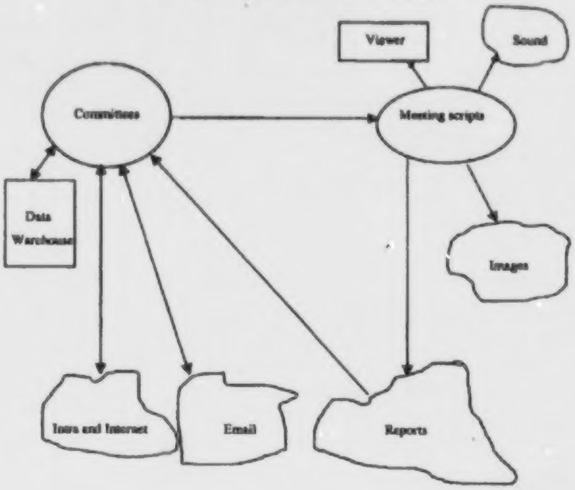
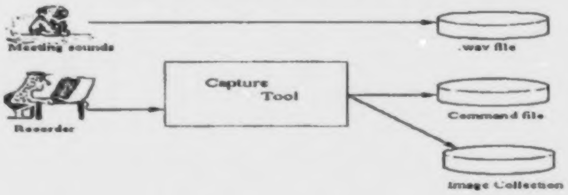


FIGURE 3
CAPTURE PHASE OF THE RECORDER



The capture tool is a Visual Basic program designed to make the task of capturing the semantics of the meeting a reasonable task. The tool is event driven and is based on the following set of fixed events.

Sound capture. Here the notion is that the recorder will need to capture events such as changes in speakers and/or changes in topic. The tool makes it easy for the recorder to capture information about who is presenting, relevant keywords, meeting time, and a relevancy index (rank). Initiation of this event assigns the current time stamp to the command file entry.

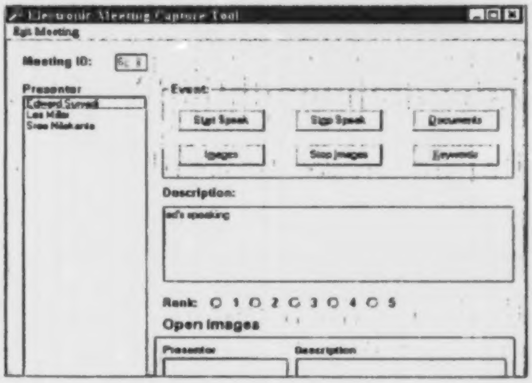
On-line image capture. The recorder can capture an on-line image by initiating this event. The image is captured from the screen and placed in the image collection. In other words the image is placed in a file and the file name along with a system generated image id are placed in a file called the image file. The program also creates an entry for the command file consisting of the current time stamp and the image id. The recorder can supplement this information with the presenter of the image (who), meeting time (when), relevant keywords (what), and a relevancy index (rank).

Hardcopy capture. This event allows the recorder to capture the relevant information about any transparencies or charts used during the meeting. The information captured is similar to the on-line image capture with the obvious exception that the recorder will need to convert the hard copy images to an on-line format, along with the information on who, when, what, and why.

Document capture. This event is similar to the hardcopy image capture event except for the fact that the document will be viewable as a unit and the only entry in the command file will be made when the document is handed out.

Beyond the on-line image capture event (which both captures an image and creates an entry in the command file), the main function of the last two events is to create an entry in the command file. As each event is recorded, a timestamp is added. Additional comments, keywords and a rank, indicating relevancy of the content to the goal of the meeting are also added by the secretary. Each event has a start and end point. A sample screen is shown in Figure 4.

FIGURE 4
CURRENT CAPTURE TOOL SCREEN



Les Miller

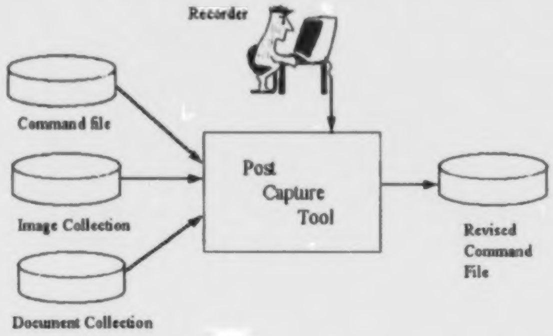
Sree Nilakanta

Description: ed's speaking

At the end of the meeting, the meeting secretary (we used the term recorder for the meeting secretary in [Miller and Nilakanta 1997] and have maintained it here for consistency) converts the documents, transparencies and charts into an electronic format. The current approach used in our design is to scan anything that the participants can't provide in electronic form. Individual images and documents are added to the image and document collections, respectively. Note that the format of both collections is a file of pointers to the individually stored objects. The result is that at the end of the capture phase, a command file, an image collection and a document collection are ready for additional processing.

We have implemented a post capture tool to allow the secretary of the meeting to incorporate more relevancy information into the command file and to synchronize the command file with the sound file. The first aspect of the post capture phase is that the recorder uses a post capture tool to replay the meeting based on the captured semantics. During this phase, the recorder can correct obvious command entry errors and insert the post meeting rank values for the objects. Note that the correctable part of a command is the time stamp, the assigned participant(s), and the relevant keywords. The relevancy index (rank) assigned by the recorder during the meeting can not be changed. The security level of the command file entries are added during the post capture phase. A block diagram of this phase is shown in Figure 5.

FIGURE 5
ORGANIZATION OF POST CAPTURE TOOL IN CURRENT IMPLEMENTATION



The result is that a meeting script is created for each committee meeting. The meeting script can then be used by the knowledge navigator subsystem to allow users to revisit meetings through selected playback.

Knowledge Navigator

A prototype of a meeting viewer has been developed to take the data captured by the recorder subsystem and present the meeting via a web interface. The software transforms the command file produced by the recorder into a new command file based on the user's security clearance. All entries that violate his/her security clearance are removed. Once the new command file is created, the user can either view the restricted portion of the meeting in its entirety or search it for keywords and view the portion of it that is close to the location of the keyword in the command file (the meaning of close is specified by the user in minutes). The prototype plays the sound of the meeting, places and removes images from the screen depending on their start/stop time, and makes documents available to the user at the point in the meeting that they were handed out. The user can replay portions of the meeting script.

Composer and Builder

Two prototypes have been designed and implemented to this point for designing and building data warehouse tables. The first prototype provides a click and point interface that the user can use to choose the format of a warehouse table from the meta-data for a set of source relational databases. Once the user has chosen the desired data warehouse attributes, the prototype uses a query generator that generates a lossless query over the relational databases or returns a message that no lossless query is possible. If the data warehouse attributes span more than one database, the query can be partitioned to create a set of queries that can then be used to obtain the required data to populate the data warehouse table. The lossless test has been designed to make use of the table names, attribute names and functional dependencies (if they are available) from the production database meta-data.

A second prototype has been developed to build the warehouse table from the query generated by the previous prototype. In this new prototype once a query is generated, the query is partitioned and a set of mobile software agents are generated to go to the data source locations, generate the required data, and return it to the interface for storage in the data warehouse. The data is automatically added to the new warehouse table when the agent returns to the prototype's interface. To this point, the prototype supports both relational databases and batch based legacy systems.

Knowledge Retriever

Our prototype for the knowledge retriever fetches information using an intelligent search process. Knowledge retriever is based on well-grounded research in the area of information retrieval. Our prototypes use the vector space model. In addition to comparing queries and documents, we make use of user or committee profiles in our prototypes. A profile is a list of possibly weighted terms provided* by a user, which reflects the users or committee's long-term interests. Initially, a profile can be created manually or based on a set of relevant documents. Documents, queries and profiles all are represented by term vectors at retrieval time. The full system consists of three parts: indexing the documents, weight assignment and retrieval or filtering.

During the retrieval phase each query, document and committee profile is represented by a list of weighted terms to reflect the relative importance of terms. The weight of term tj in document di is defined by $wt(i,j) = tf(i,j) * \log(N/df(j))$, where N is the total number of documents in a collection and $tf(i,j)$ and $df(j)$ are term and document frequencies as defined above.

The similarity between a document and a query or a profile is represented by the mathematical properties of the vectors. For a document D and a user query or a profile Q, let DD = char(D), QQ = char(Q), then the similarity between d and q is defined by

$$SIM(D, Q) = \cos(AngleOf(DD, QQ)) = \frac{DD \cdot QQ}{||DD|| * ||QQ||}$$

where

$DD \cdot QQ = \Sigma\, DD[i] * QQ[i];$
$||DD|| = sqrt(\ \Sigma\, DD[i] * DD[i]\ )$ *and*
$||QQ|| = sqrt(\ \Sigma\, QQ[i] * QQ[i]\ )$ are the norms of vectors DD and QQ, respectively.

All the documents are ranked by this similarity coefficient. Documents whose similarity coefficients exceed a predetermined threshold are retrieved.

A relevance feedback mechanism has been provided to modify the original query or profile to achieve better retrieval performance. Based on the feedback from users, term weights in the committee profile are changed to reflect the committee's actual interests.

The current prototype has been implemented using mobile software agents to connect the user interface with the document collections. An earlier version of the prototype [Hu et. al 1998] used a more typical interface to a file of documents to support the knowledge management process.

Knowledge Percolator

There are numerous opportunities in an organization to generate knowledge. Since our approach is committee-based, we have focused to this point on analyzing committee decisions. Our current prototype is only the first step in developing this aspect of the model. The obvious choice to start analyzing the committee decision process is to look at the information in the data generated by the committee meeting.

In our current prototype we made use of a neural network to model the decision process of committees. The command file generated by the recorder contains the necessary information, but can not be used directly. It requires transformation into a format that can be used by the neural network. To aid in the transformation process, the prototype incorporates a set of transformations based on sliding a window over the records in the command file.

The command file entries are used by the transformation to generate the specified statistics for each member of the committee. The prototype assumes that the committee membership consists of the union of the attendees of the set of meetings that are being processed. The **decision-variable** is set to *true* if a decision has been reached in the command file records covered by the window and is set to *false* if no decision has been reached.

The focus of the current software is to look for activity patterns in the meeting that result in decisions. The transformed file is used to construct a neural network. The **decision-variable** serves as the classifier in the training set for the neural network construction. Once the prototype has build the neural network, the neural network can be used to generate a set of rules for the decision making process within the committee. The motivation behind this approach is to develop a methodology for setting up committee meetings to optimize the decision process.

CONCLUSIONS

A model of a knowledge management environment has been given. The model takes a committee-based approach and uses committee meetings as the primary data collection point. The assumption is that more traditional forms of data (databases, data warehouses, and report libraries) are easy to generate and the major concern is to incorporate them in with the knowledge management process. Existing prototypes for the components of the model have been briefly overviewed to address the feasibility of the model.

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COLLABORATIVE LEARNING AND GROUP ASSESSMENT: INTRODUCING THE CAPITALIST AND SOCIALIST PARADIGMS

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ABSTRACT

The use of advanced learning technologies enables various new forms of collaborative learning and group assessment. This paper outlines a radically different model of student assessment to that traditionally used in most universities and other educational institutions. The model is particularly suited to those using, or seeking to use, collaborative learning techniques, which are themselves in turn greatly enabled by the use of asynchronous learning technologies. The advantages and disadvantages of the assessment model are discussed, and various methods of implementing the model are suggested.

INTRODUCTION

Suppose that the instructor has a choice of two possible models of course delivery, and can reasonably predict in advance that if the first is employed, then 80% of students will pass, with varying grades (A, B, C, D etc), and that 20% of students will fail; and that if the second is employed, all 100% will pass, but mostly with low pass grades (Cs and Ds). Suppose further that the grades are actually a true and accurate reflection of the students' learning. Which model should be preferred, and why?

This is not a question that has been much debated in the literature, and the correct answer is not obvious. For example, suppose the former is preferred. Would the decision be different if the latter were to produce mainly Bs and Cs instead of Cs and Ds? What if the former produced only 70% passes? 60%? And so on.

The mean or median grade could be used to prefer one method over the other. If these are roughly the same in the two models, however, that cannot assist the decision. In such cases the former method, with a variety of grades is often preferred perhaps because that is less likely to be questioned at subsequent examiners meetings!

At some point, however, a decision may have to be made between encouraging a variety of grades (usually considered a good thing) and increasing the number of students achieving passing grades (also usually considered a good thing).

THE CAPITALIST MODEL OF ASSESSMENT

There is no such thing as a standard method of assessment common across university courses. Rather, methods of assessment vary enormously from course to course, subject to subject, and university to university. For example, assessment may be comprised entirely of an end-of-term examination, or may be comprised of a number of assignments plus an end-of-term examination, or a number of assignments only. Assignments can be theoretical or practical in nature. The end-of-term examination may be open book, or closed book, or of a take-home type. All assignment items may count towards the final grade, or only a selection. And so on through many other possible variations.

Nevertheless in all of these cases the final grade is usually based on the student's own work, as demonstrated in one form or another throughout the course. Students often "compete for grades even when assessment is criterion-based, and no element of competition actually exists.

In what follows, this will be referred to as the capitalist model of assessment.

COLLABORATIVE LEARNING AND THE CAPITALIST MODEL

Collaborative learning is hardly a new topic. The importance and relevance of social interaction to an effective learning process has been stressed by many theorists from Vygotsky [18], through advocates of situated learning such as Lave and Wenger [10], and has been confirmed by many more recent researchers and practitioners, such as Kagan [7] and Johnson and Johnson [6].

An up-to-date review of the research and the long history of peer/collaborative learning can be found in [11]. A small but select annotated bibliography on collaborative learning can be found at [12], while an excellent list of strategies and tips for those interested in introducing collaborative learning can be found at [2].

Salomon [17] amongst others has pointed out that despite the mass of literature praising collaborative learning, teams very frequently do not work well, and lists as common problems the "free rider effect [9], the "sucker effect [8], the "status sensitivity effect [3], and the "ganging up on the task phenomenon [16].

The use of collaborative learning techniques specifically within certain topic areas has not received much attention, though definite benefits have been found, for example, with their use in the teaching of a computer science curriculum [21].

This paper extends the topic of collaborative learning, to include, as an integral component, group assessment. Webb [19] lists six positive reasons for employing some form of group assessment. It is suggested here that there may also be other more important reasons specifically, that its use can have a significantly positive effect on the learning outcomes of the students.

FROM COLLABORATIVE LEARNING TO GROUP ASSESSMENT

It is important at the outset to distinguish collaborative learning from group assessment. There are a number of forms of collaborative learning that can be used, from small informal group discussions where the groups vary from week to week, through to formal group projects where the groups remain fixed throughout the term.

Even in such cases, assessment may still be carried out on a completely individual basis.

Where this is not the case, and some form of group assessment has been used, many schemes have been devised to try to award appropriate grades to particular individuals for example, by dividing the group work into separate items for which a particular individual is responsible, or by having the group members report on who provided the most input within the group, or a variety of other factors.

One particularly noteworthy case of implementing collaborative learning in an asynchronous learning environment is the so-called "radical model [13,14,15]. The radical model dispenses with traditional face-to-face teaching almost entirely, and places the emphasis on the students themselves to learn within a group setting, using the Web for resource material and email discussion groups for communication and presentation of assessment items, with the instructor providing guidance and feedback as required.

At the beginning of the course, the instructor randomly assigns students into groups. Each group is assigned one of the weekly topics, and has to make a single online presentation. Students are assessed not just for their group's presentation but also for their comments about other presentations. Each group presentation is also assessed on the quality of the discussion that follows. Typically, by the end of semester, students will have received over 100 inputs on their work from other students in the group, other groups, and the instructor.

In the last week of term, students are invited to submit a recommendation in writing on each other's group performance. The instructor considers any such recommendations when allocating individual marks for group performance to members of the group. A student that a group decides did not contribute sufficiently may as a result suffer a reduction in mark.

Different assessment criteria may be used for example, for the electronic presentation, clarity and structure of presentation, originality of ideas, and ability to substantiate arguments by relevant data; for other contributions, understanding the arguments that are made by other presenters, linking them to the relevant literature, and making pertinent critical comments about these arguments.

The students' final marks are based on a combination of their group work throughout the semester, and their performance in an end-of-semester examination.

In common with some other forms of collaborative learning, the radical model points the way towards other possible forms of assessment in an asynchronous learning environment. However, as presently constituted, the model still represents an example of the capitalist model of assessment, since the grade awarded is based on the standard paradigm of attempting to assess the individual's own efforts, even within the context of an online collaborative learning environment.

THE SOCIALIST MODEL DESCRIBED

In the socialist model of assessment, achieving the best outcome for a particular individual or small group of individuals is regarded as secondary to achieving the best outcome for the class as a whole.

In all instantiations of the socialist model, effort is expended in ensuring that the most able students assist the least able. In this way, knowledge and skills can be successfully passed on outside the presence real or virtual of the instructor.

This is often achieved via various forms of collaborative learning, where it is hardly controversial. To incorporate the same philosophy into group assessment is, however, another matter.

At its minimalist, this philosophy can mean dividing the class into groups, and assessing each group as a whole, without attempting to differentiate the grades of the individuals within the group. Providing this strategy is made clear at the start of the process, it is clearly in the best interests of the individuals within the group to ensure that the group as a whole performs to the best of its ability. Unfortunately, this is often achieved in practice by one or two members of the group performing the bulk of the work, and in such cases it is common for the weakest members of the group to learn little or nothing [8,9].

Other strategies can be employed to overcome this difficulty, however. The first is to make it known that one or more member(s) of the group will be chosen at random to represent that group in each item of assessment, be that a written test of some sort, or an oral examination, or whatever. Another strategy is to let it be known that the instructor will deliberately select the member(s) of the group perceived to be weakest in that subject area on each occasion. In either event, all members of the group are awarded the marks attributable to the selected member(s).

Hence there is enormous incentive for skills to be passed amongst the group. To avoid any "rigging of the system, students who withdraw prior to an assignment task should not be eligible for any mark for that assignment, while all other members should receive equal marks.

What if one or more members of a group are particularly weak? This unfortunate, but not uncommon, situation can be remedied in part by ensuring that the membership of each group is changed for each assessment item.

Another factor that can be varied is the allocation of students into groups. For example, whether to (a) let groups decide membership for themselves, or (b) randomly allocate students to groups, or (c) allocate students to groups according to some prearranged strategy. The composition of each group plays a far greater role within socialist models of assessment, and so this decision assumes some importance.

In (a), the socialist model is mitigated to some extent, since there is some evidence that the most able students will seek to group themselves together by choice, leaving the lesser able to form their own groups. In such cases, the final range of grades is likely to be not dissimilar from a standard capitalist model.

In (b), the random option, the socialist model is likely to work best since both the perception and the reality is that one's fellow group members are there as a result of the luck of the draw. It is therefore incumbent on each group to work together as best as it can.

The danger with (c) is that, whatever strategy is employed, the final group structure can be perceived as having been deliberately set up to advantage or disadvantage certain students. It is therefore a high-risk strategy for the instructor, even if the method of selection is made transparent.

ADVANTAGES OF THE SOCIALIST MODEL

The socialist model has so far been suggested primarily as a means of assisting the lesser-able students to achieve better grades than might otherwise be expected; and it has been implied that this usually occurs at the expense of exceptional grades for those more able.

However, it is quite possible that the socialist model of group assessment might in fact advantage all students. It is often said by academics and instructors generally that the best way to learn a subject is to teach it, and for good reason when teaching, one needs to gain a thorough knowledge of the subject, not only to prepare material, but also to be able to answer questions confidently. No matter how good the preparation on the part of the instructor, further questions will almost inevitably arise during the course of instruction, thus leading to an even better understanding.

It seems naïve in the extreme to assume a similar process will not occur when the students themselves take on the role of instructors to other students within their group. Thus, it can be expected that in many cases the socialist model of assessment will increase the learning of all students within the group, and not just those who are least able to learn for themselves. This conclusion seems to be supported by previous research in this area.

For example, Webb and Sugrue [20] report that "amongst groups with above-average students....the higher level of discussion translated into an advantage in the achievement tests for the below-average students (in those groups) , both when they were tested on a group basis and also individually. On the other hand, "high ability students performed equally well in heterogeneous groups, homogeneous groups, and when they worked alone. Both of these results have also been shown in different contexts by other researchers [1,4,5].

THE MIXED MODEL

Despite the possible advantages listed so far, it is unlikely that many instructors will be prepared to embrace the socialist model whole-heartedly, for fear of falling foul of either aggrieved students or institutional procedures, or both.

There is a half-way house, however: in a mixed model of assessment, the pure socialist model is combined with the capitalist model. For example, one valid mixed model would be for each student's final grade to be dependent upon a number of group assessments throughout the semester, and an individual examination. Clearly in such cases the weighting of each can be easily varied from zero to one hundred per cent, thus allowing the instructor to select the appropriate mix with which they feel most comfortable.

SUMMARY

A non-standard model of student assessment has been described, which is best suited to those courses where collaborative learning is already in use or is being seriously considered.

It is of course of vital importance that the students be made fully aware from the commencement of the subject as to the assessment model to be employed, and understand its implications for the class as a whole and for themselves as individuals. The use of a form of the socialist model described here can then be expected to benefit the less-able students, resulting in an increase in the percentage of students able to achieve passing grades.

Since a shift to the socialist paradigm may seem too radical a step for many instructors, a mixed model has been described which may enable experimentation, and hence the gathering of empirical results in this area.

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A META-ANALYSIS OF RESEARCH ON STUDENT TEAM EFFECTIVENESS: A PROPOSED APPLICATION OF PHASED INTERVENTIONS

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ABSTRACT

Despite the increased emphasis on team work in the academic environment, managing a student team so that the team process is effective remains problematic. In fact, some professors believe we are teaching students ineffective team behavior such as "free loading" or relying on star performers and procrastination. Most research on student team process uses students as surrogates for business world teams and draws conclusions for that domain. This study examines prior research on student teams, performs a meta-analysis of this literature, derives a set of interventions found to be effective with student teams, and proposes a planned application of these interventions.

INTRODUCTION

According to Jones (1996, 80), "inappropriate use of teams can undermine the educational process so badly that learning does not take place, students learn how not to learn, students build an attitude of contempt for the learning process." Indeed, satisfaction with a team-based MBA program was negatively associated with the cognitive abilities as measured by GMAT scores of students (Baldwin et al, 1997, 1382, 1384,1385):

> It seems likely that the most talented students may feel burdened with responsibility for helping others and feel they are minimizing their own learning or development . . . Conversely, the students performing at the lowest level enjoy a more naturally occurring level of support in a team-based structure and may consequently report higher levels of satisfaction with their experience . . .
>
> The negative association of workload sharing with team grades suggests that in a significant number of teams, a few stars carried disproportionate shares of the teams' workloads. This finding would also help account for the lower satisfaction reported by students with high cognitive ability. It may also confirm the fear of the M.B.A. instructors that say a bright student skilled in finance might end up doing most of the financial analysis for team assignments at the expense of the learning of others.

Jones (1996, 85) concurs and finds that "the high performing members of the [student] team get a workout." He cautions against "confusing business and education environments." Many of the business controls for performance are lacking in the education environment. For example, "People build a history of accomplishment in a company. They carry their reputations with them and non-performers eventually get their due. There are a whole host of incentives built into the business environment that fosters a high level of team commitment."

An ABI Inform search on the broad term "student teams" over the past fifteen years produced 451 articles. Yet despite the face validity of Jones' argument that student teams differ significantly from teams in the business environment, almost all of these articles used student teams as a surrogate for business teams and drew conclusions linked to business team performance. Only six articles focused on learning how to make student teams more effective and recognized that differences in students versus experienced professionals, differences in work environment versus classroom, and differences in the incentives for behavior make student teams a special case for researchers. This study examines prior research on student teams, including some of the research which uses student teams as surrogates for professionals. Then, a meta-analysis of this literature is performed, deriving a list of interventions which prior researchers have found to be effective with student teams.

PRIOR RESEARCH

Applying systems principles from Senge's *The Fifth Discipline,* Jones (1996, 85) identifies systemic problems and solutions for student teamwork. The delay in feedback is a root cause of non-performance on student teams. Because "student teams do not have ready-made structures and procedures through which accountability and authority can function to quickly identify and correct poor performance" and because "it takes time to build consensus to deal with non-performance," non-performers rarely get feedback within the severe time constraints of a quarter or semester. Therefore, non-performers rarely improve their performance. Jones seeks to develop "robust team systems" which will "promote patterns of behavior that support the goals of the education process."

One important structural component of a robust team system is the use of frequent, scheduled team meeting. According to Jones (1996, 85), "the fewer the meetings, the more delay or sluggishness in feedback." The lack of feedback means that there is rarely an attempt "to get non-performers to do their share." Frequent regularly scheduled meetings increase feedback and thus the opportunity to increase workload sharing.

Jones' (1996, 87) experience has been that "even a small amount of training [on working in teams] can produce dramatic increases in team effectiveness and efficiency." Other quasi-experimental studies (Mennecke et al., 1998) have reached the same conclusion. Regular, frequent feedback from team members and the instructor are critical for effective student teams.

Rapid and frequent feedback is the first principle for effective student teams according to Jones. This feedback is facilitated by frequent meetings and training on team process. This feedback pertains not only to the project content but to project team processes. The second principle is "individual accountability and responsibility [which] extends beyond the boundaries of the team" (Jones, 1996, 87). Students receive individual and team grades, with many components of the project being graded. Thirdly, Jones (1996,88) has found that student teams must have "an early and high level of team member interaction." He finds that "frequent team meetings" and "frequent small outputs from the team" increases feedback and allows performance problems with individual team members to surface more quickly and early in the academic term.

When teams are diverse, "periodic process feedback may be a key" to effective teamwork (Watson et al., 1998, 164). They find preconditions for teams becoming more instead of less effective over time: time for team discussion, feedback on both interpersonal and task performance, and linkage of individual to team performance. Although their research uses student teams as a surrogate for industry teams in a study of team diversity, they used peer evaluations at midterm and at the end of the term. The feedback provided by peer evaluation "can remove students' fear of having to choose between either low grade or having to do most of the group work (if other members fail to do their fair share" (Roebuck, 1998, 40). Students evaluated each other on both interpersonal and task dimensions. Instruction was also provided on effective teamwork topics.

McKendall (2000, 281) has found that when team process is employed, students find that working in teams takes much longer than their previous experience with group work. Part of the difference may be because team projects without processes to ensure workload sharing result in a few students devoting time to the project while others have much less of a time investment. However, the team processes themselves take time. So Kendall incorporates meeting time into class time and assigns people to teams based on their schedules and ability to meet at the same times. However, she still finds that instructors who employ team processes must "be prepared for a lot of disgruntlement over the project grade" (McKendall, 2000, 281). Students believe that the time invested in the project makes them deserve an A. She cites the following problems with projects that do not deserve an A:

> They chose a problem too quickly without fully investigating whether it is indeed a problem, they leapt too quickly to a solution, they did not interview a key person, they wrote their action plan but forgot to pace themselves and burned out before completion of the project, they failed to confront those who were not producing . . . Given the large amounts of time and effort invested, however, they are not willing to see the errors reflected in their grade.

Still, she (2000, 281) finds that "approximately two thirds of the teams report that their group worked better than any other group in which they had participated (some of them seem to attribute this to a happy fluke, which can be a bit frustrating)." A reflective essay on the team experience provides some evidence of increased self-awareness. Team process constraints employed by McKendall include a team contract, instruction in individual differences, collaboration, listening, problem solving, decision making, action plans, group roles and leadership, team communication patterns, conflict and cohesion. Each team presents its completed project and team members evaluate each other.

Gardner and Korth (1998) find it important to address problems students have experienced with teamwork in the academic environment (mainly that a few students do all the work) and to stress the use of teams in the work environment. They assign students to teams based on learning styles.

Siciliano (1999) established team ground rules by having the class develop a profile of an ideal team member. The profile consisted of four major components with detailed descriptors of those components. At midterm, each team member was evaluated by team peers using the four major components and a scale from 1 to 5 (Siciliano, 1999, 263):

5 = always performed this way
4 = often performed this way
3 = occasionally performed this way
2 = rarely perfomed in this way
1 = never satisfied this criteria

Average peer ratings were calculated for each student and shared with each student. Class averages and team averages were provided. Students were asked to develop a plan for improving their team performance. At the end of the term, the evaluation was repeated and became a grade component. Ratings were confidential for both administrations. Rajlich et al. (2000) found a statistically significant gap between how students perceive their perfomance on a team and how other students on that team perceive their performance. Although not empirically tested in this study, midterm evaluations shared with each student in summary form should work to lesson that gap and improve performance, as was Siciliano's experience. Rajlich et al. were not focusing on student teams but using student teams as surrogates for professional application development teams.

TABLE 1
SICILIANO'S (1999, 263) IDEAL TEAM MEMBER CRITERIA

1. Do your part	Complete the tasks assigned to you
	Be willing to put in the time necessary to complete your team assignment
	Ask if there is anything you can do
	Pull your own weight and do your share of the assignments
2. Share your ideas	Express your opinions
	Respond to other group members' ideas
3. Work toward agreement (consensus)	Be open to other ideas, opinions, and perspectives
	Be willing to work together
	Work as a team (not solely on an individual basis)
4. Keep a positive attitude	Maintain a sense of humor
	Be courteous
	Give feedback in the form of constructive criticism

Prior researchers have found meeting management as well as meeting frequency to be important for effective team process. Shrage (1995) in his book, *No More Teams!*, a reaction to the misuse and mismanagement of teams in the work world, coined the term "meeting ecology," emphasizing attention to factor promoting productive meetings, hospitable meetings, and meetings which generate commitment rather than apathy. Clark (1998) focuses his research on improving student team meetings. He begins his work with students by assigning readings on the importance of learning to work in teams and the importance of effective meetings for teamwork. He cites the estimated $37 billion (Kayser, 1990) lost annually in the United States due to poor meeting management. Studies have shown that people gain enthusiasm or commitment when they play a predefined role at a meeting. Clark (1998) cites the use of the scribe role or the scheduler role. Meetings are more productive if they are planned with agendas issued prior to the meeting. Meetings are more productive when each member has prepared prior to the meeting, often sharing documents with each other prior to the meeting. Finally, Clark finds that meetings are more productive when the focus is on an action items not information sharing. Clark finds that detailed meeting minutes and the role of scribe are essential for productive meetings. They prevent rehashing old issues or debating decisions already made.

McKeague et al. (1999) require weekly meetings and weekly reports in their marketing/engineering project, and they count these meetings with an accompanying weekly project report as 5% of the course grade. Each meeting must also be recorded in a meeting journal. Each student on the team must keep this journal. A key finding of their study was that the grade on the project journals, used an independent variable in a regression analysis, is a significant predictor of the final project grade. During the term, student teams make five oral presentations of project progress to a faculty panel, so each student team receives frequent feedback before delivering the final written report.

In a study of meeting agendas in the group support system context (Niederman and Volkema, 1999) found three benefits of employing agendas: improvement in the quality of meeting deliverables, increased group satisfaction with meeting results, and increased satisfaction with the overall process. These benefits were empirically tested using a survey of 238 group facilitators.

Mennecke and Bradley (1997) used predefined roles for team members and find that group cohesion is significantly improved. Other interventions, such as weekly meetings and frequent feedback structures, were not employed in this study. Porter and Bryan (1996) find cohesion to be a problematic measure because it is not correlated with performance. Eighty project teams and 464 students participated in their study. Their findings indicate a moderating affect for the cohesion dimension related to performance. Cohesion has three dimensions: "commitment to task, group attractiveness, and group pride" (Festinger, 1950). They focus on task commitment as a positive impact on student team performance. Instead, they find a direct impact comes from task process, "behaviors aimed at organizing members to get work done . . . setting goals, prioritizing work, developing workable plans that facilitate task accomplishment" (Porter and Bryan, 1996, 364). Although Porter and Bryan are using student teams, they seek to empirically test theory concerning work team performance. Their "findings suggest that management would do well to structure the team [task processes] so that [negative, unproductive] task conflict is minimized" (1996, 374). Mennecke et al. (1998, 110) subsequently added two interventions: "1) training on group process and 2) role assignment." Again, they found higher cohesion and better project grades when roles were assigned compared to a control group. The highest cohesion and highest grades came from the teams where the added lessons on group process and roles were also employed.

Stephens and Myers (2000) adapted the use of defined roles (Mennecke and Bradley, 1997), removing the role of student liaison with the professor. Instead, they implemented structural interaction of the entire team with the professor throughout the term. Cohesion was not used as an outcome measure. They added a structure of weekly team process constraints designed to solve key problems: procrastination and free loading (Stephens and Myers, 2000). Constraints included regularly scheduled weekly meetings preceded by an agenda and followed by minutes. A weekly action list was also required in which the distribution of specific work tasks among the team was identified by student and time lined. Finally, they added peer evaluation with each team member rating the contribution of peers on each project component. Satisfaction with the team experience was significantly higher with the treatment group than with the control group who were simply assigned the project in teams with no role or process constraints applied. The treatment group perceived the roles to be valuable and found the weekly meetings with action lists to be particularly valuable.

INTERVENTIONS FOR EFFECTIVE STUDENT TEAMS

Based upon this prior research, instructors may choose to exert control over task process through using interventions. Table 2 summarizes the interventions employed to increase the effectiveness of student teams.

Instead of assigning a team project and then grading the deliverable at the end of the term, the instructor may address workload sharing and thus learning for individual students providing rapid, frequent feedback. This feedback can be based on project deliverables, weekly meeting agendas, minutes, and action lists,

TABLE 2
META-ANALYSIS OF PRIOR RESEARCH
INTERVENTIONS FOR IMPROVING EFFECTIVENESS OF STUDENT TEAMS

Interventions	Source(s)
Rapid, frequent feed-back on team process (documentation in form of reports, minutes, agendas, action lists, meeting journals) and project content (reports, presentations, project deliverables)	Jones (1996), Watson et al. (1998), McKeague et al. (1999)
Frequent, regularly scheduled meetings	Jones (1996), McKeague et al. (1999), Stephens and Myers (2000)
Training on working in teams	Jones (1996); Mennecke et al. (1998); McKendall (2000), Siciliano (1999)
Individual as well as team accountability	Jones (1996), McKeague et al. (1999)
Peer evaluation	Watson et al. (1998), Roebuck (1998), McKendall (2000), Siciliano (1999), Rajlich et al. (2000), Stephens and Myers (2000)
Team contract	McKendall (2000)
Reflection on team experience	McKendall (2000)
Student evaluation of other team projects	McKendall (2000)
Lessons on importance of teamwork	Gardner and Korth (1998)
Discussions of prior problems with teamwork	Gardner and Korth (1998), Siciliano (1999)
Assign to teams based on learning styles	Gardner and Korth (1998)
Development of ideal team member profile	Siciliano (1999)
Attention to meeting management	Clark (1998), Stephens and Myers (2000)
Weekly scheduled meetings	McKeague et al. (1999), Stephens and Myers (2000)
Meeting time in class	McKendall (2000)
Defined roles in meetings	Clark (1998), Mennecke and Bradley (1997), Stephens and Myers (2000)
Use of meeting agendas	Clark (1998), Stephens and Myers (2000)
Use of meeting minutes, journals	Clark (1998), McKeague et al. (1999), Stephens and Myers (2000)
Team process as grade component	Stephens and Myers (2000)
Meeting management as grade component	McKeague et al. (1999)
Use of e-mail for information sharing prior to meetings	Clark (1998), Stephens and Myers (2000)
Use of action lists in meeting	Stephens and Myers (2000)

meeting journals, milestone presentations, and midterm peer evaluations. Predefined roles for team members, training on team process, discussion about what makes for an ideal team member have all been shown to improve team performance. Linking the rapid, frequent feedback components to the project grade at an individual level helps to make individuals as well as teams accountable and provides external intervention for non-performers, the same kind of intervention a project manager would provide in the business environment.

CONCLUSIONS AND FURTHER RESEARCH

The interventions identified in the meta-analysis may be grouped by interventions appropriate for project initiation, for work on project deliverables, and for project closure. Table 3 provides a guide for the phased application of interventions shown to be effective through prior research.

Much work remains to be done on increasing student team effectiveness. Business schools continue to employ student teams in many courses, and to emphasize the importance of teamwork. Certainly, teamwork is an integral part of an information systems majors' education. Research supports the view that students do not learn to work in teams effectively by simply being given a team project or assignment. They may, in fact, learn the opposite from intended lessons. We need to establish a body of research on interventions for effective student teams, given the constraints of the academic environment, by tracking interventions employed and results achieved. Clearly, more empirical research is needed on student teams as student teams and not as surrogates for professionals in the business environment.

TABLE 3
PHASED APPLICATION OF INTERVENTIONS

Project Phase	Interventions
Initiation	Assign or allow to self-assign to teams based on schedules, profile of ideal team member, learning styles, personality type or some rational criteria.
	Discuss importance of teamwork, problems experienced with student teams, ways to resolve these problems, meetings management.
	Teams formulate a contract which specifies criteria for non-performance.
	Require meetings early in the term (allowing some class time for meetings to observe interactions) for project identification, contract formulation. Frequent meetings early in the term help to identify low performers and influence their behavior.
Work on Project Deliverables	Required regularly scheduled weekly meetings with weekly reporting in the form of agendas, minutes, action lists, meeting journals. Allow some class time for meetings.
	Predefined roles in meetings and in project activities.
	Weekly grades based on meeting deliverables.
	Individual grades on some deliverables which should be prepared prior to the team meeting where the team version will be developed.
	Use of e-mail to facilitate information sharing.
	Periodic brief lessons on effective team process topics.
	Milestone presentations in which students evaluate other teams and receive feedback from the instructor (3 recommended).
	Mid-term peer evaluations with feedback summarized for each student.
Closure	Peer evaluation.
	Assessment of how well feedback was used.
	Assessment of team process.
	Assessment of project deliverables.
	Student reflection on behavior in the team, the team process, and the learning experience.
	Instructor reflection on team process effectiveness.

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A COMPARISON OF E-COMMERCE AND INFORMATION SYSTEMS JOB TYPES: IS THERE A DIFFERENCE? A PANEL DISCUSSION

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Extended Abstract

Electronic commerce, or e-commerce, has changed the way we do business both domestically and internationally. According to a report released by Iconocast (2001), consumers will buy $74 billion worth of goods online in 2001 and that figure is expected to grow to $2.7 trillion by 2005. The world's 60 million businesses will spend $6.3 trillion worldwide using business-to-business (B2B) Internet commerce by 2005, up from $3.4 billion in 2000.

To prepare students for employment in the Internet economy, many universities have begun to offer degrees in electronic commerce in addition to their traditional information systems (IS) programs. However, e-commerce curriculum has varied significantly from program to program.

In a 1999 survey conducted on e-commerce academic programs, it was found that the amount of e-commerce course offerings tripled between 1998 and 1999, and there were five times as many courses offered in 1999 as there was in 1997. The majority of the courses investigated, approximately sixty-one percent, could be defined as e-business *overview* or survey courses, which included various multidisciplinary concepts (Sendall, 1999).

As e-commerce degrees continue to proliferate, higher education will benefit from an understanding of what set of skills the industry requires of recent graduates to be successful in the Internet economy. As that begins to take shape, industry will too benefit, as employers will be able to anticipate that graduates entering the workplace will have coherent e-commerce foundation knowledge.

What are the skill sets required of graduating students seeking employment in the field of e-commerce? Do they differ from the skill sets required for employment in other areas of information systems?

METHODOLOGY

A study performed by Landry, Longenecker, Haigood & Feinstein (2000), compared various information systems (IS) job types based on IS faculty perceptions of the skills that comprised each job type (See Appendix A). A "job type" is defined as an IS specialization area, based on that specialization's corresponding job in industry. A "skill depth" is used to describe the level of understanding of a learning objective, according to Bloom (1956).

The authors believed that by "isolating the various skill depths for different IS jobs" the study would, "contribute to efforts toward defining a more specialized IS curriculum." The study concluded, in part, that one of the objectives of future studies ought to be to determine what skill elements and career paths, if any, are currently missing in IS curriculum.

Another study by Longenecker, Feinstein, Haigood and Landry (1999) collected one thousand ads from Internet publications in 17 major national newspapers. Each ad consisted of words or short phrases that were grouped and categorized under the exit curriculum sub-areas of the IS '97 Curriculum Model for Undergraduate Degree Programs in Information Systems (1997).

Employing the same methodology as in the study cited above, we will conduct a content analysis by word frequency counts using "e-commerce" as a modifier, and compare the results to the exit curriculum sub-areas, or tasks performed by IT professionals, as identified in the IS '97 Curriculum Model. The panel will discuss if any skill elements are missing from IS curriculum that prepares students for careers specifically in e-commerce.

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APPENDIX A
SKILL DEPTHS ACROSS INFORMATION SYSTEMS JOB TYPES

1. Individual and Team Interpersonal Skills
    - 1.1 Learning, Encouraging, Listening
    - 1.2 Being Organized
    - 1.3 Committing/Completing Work
    - 1.4 Ethics
    - 1.5 Writing
    - 1.6 Speaking
    - 1.7 Vision/Mission Development
    - 1.8 Self-Directed
    - 1.9 Leadership
    - 1.10 Time Management

2. Business fundamentals
    - 2.1 Business Process and Functions
    - 2.2 Traditional responsibilities—Accounting inbound/outbound logistics and distribution, HR, Production, Marketing
    - 2.3 Business Relationships and Mechanisms

3. Systems Analysis and Design—Strategic utilization of IT, systems theory/thinking, IS Planning, IS development, customer focus

4. Software Development—Application development, client-server programming, problem solving

5. Web Development—Website design and management, web programming

6. Database—Modeling, design, procedures, administration

7. Systems Integration—Hardware, Networking, LAN/WAN, OS, Management/Interoperability

8. Project Management—Team Leading, coordination, scheduling/tracking, resource management, lifecycle management

WORKSHOP:
INCORPORATING THE SOCIAL DIMENSION INTO THE E-BUSINESS CURRICULUM

Workshop Leaders

Candace Deans
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Consultant/Relationship Coach

Currently the rate of change in the business world exceeds human capacity to process that change. This includes virtually every facet of commerce in every part of the globe. The internet and resulting e-business applications, wireless communication, broadband and the PC are only one set of components in this sweeping series of changes. Areas such as biotechnology, the Human Genome Project, bots and robotics add additional complexity and suggest that the rate of change may increase even more in the short term. All of this and more creates a workplace and a society unlike any we have lived through in the history of human beings.

It is vital that we understand and seek to utilize all that technology can offer that will enhance both life and business. In the frantic pace that exists in the marketplace it appears that a "lemming-like" rush is on to embrace the latest technology with little awareness or concern as to what impact these devices and approaches may have on our lives as people. Failing to ask forward thinking, probing and difficult questions consigns us to allow unnecessary and unhealthy risk to enter both the business world and our personal lives as well.

For example, does the practice in France of virtually everyone taking off six weeks for vacation suggest a country that risks missing out on the e commerce boom or a group of people who have thought out their values in critical areas more thoroughly than we in the West have done? Do our 14-16 hour days really help us in the long run? What issues demand attention if we seek to plan long term work careers? Issues of how much is enough and the growing global disparity in wealth and resources require attention as well. These are some of the questions that will be explored in this seminar. Experience tells us that few if any take time to even reflect on these questions.

This workshop will focus on long-term social implications of current and emerging technologies in the context of e-business. This is a perspective that few have addressed but one that is becoming increasingly important. Balancing the demands of personal and work life have always been difficult but especially so in today's fast paced business environment. Humans cannot sustain the fast paced speed at which decisions are being made. Being connected through e-mail and mobile phones 24/7 leaves little opportunity to completely disconnect from work. Learning to balance all these demands with family responsibilities is a challenge for most. Businesses who have addressed these issues have experienced positive results.

Social implications go well beyond the individual and personal domain. The digital divide between the haves and have nots continues to widen globally. As the world becomes smaller and more connected, cultural barriers will become less pronounced. The networked electronic world of the future holds many potential social implications that should be addressed proactively today.

In addition, as educators, we need to train the next generation of businesspersons as those capable of leading others into places of balance and connection. How can such issues be raised in classes where the drive seems to focus solely on how much money can I make? It is imperative that we raise these questions and incorporate a discussion of these issues in our current curriculum.

Participants will actively reflect on these and other issues during the workshop session. They will be exposed to the emerging role of the relationship coach as one way of addressing these issues from the business perspective.

Overall Objectives

- Heighten the awareness of these emerging social issues
- Identify the questions and issues we should raise
- Recognize the importance of incorporating this dimension into the current e-business curriculum

Major Issues to be Addressed

- Work/life balance
- The Digital Divide—Global Implications
- Technological advances in biotechnology, nanotechnology and information technology—their combined influence on society
- Robotics technology and its implications for future generations
- Influence of these trends on business school curriculum

FACTORS AFFECTING SYSTEMS IMPLEMENTATION: THE CASE OF ENTERPRISE RESOURCE PLANNING SYSTEMS

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INTRODUCTION

A crucial topic in Information Systems curricula is the implementation of systems. Systems analysis and design is a required course in most IS programs. One of the most important lessons in a systems design course, or even in a general Information Systems course, is that all systems are not always successfully implemented.

Organizations adopt information technologies to remain competitive, to raise productivity, and to improve decision making (Alavi and Joachimsthaler, 1992). In early studies of technological innovations, it was assumed that once a technology had been adopted, implementation would follow more or less automatically. Yet approximately 40% of all Information Systems projects fail or are cancelled (Silverman, 2000). Information technologies have the potential to change entire industries. But although the capabilities of these technologies become more and more sophisticated, the technologies themselves are often under utilized or do not meet their potential.

FACTORS AFFECTING IMPLEMENTATION

There are a number of factors affecting implementation success and failure. The larger the project, the greater the risk. When a system involves many different facets of the organization, it becomes more difficult to manage, coordinate and plan for. The larger the system, the more things that can go wrong. Testing is another factor. Testing is essential with any system no matter how large or small. But when a system is complex, testing becomes much more complicated. Each module itself needs to be tested, as well as the integration of different modules, and in some instances the integration of the entire system with other external systems with which it will interact must also be tested. Adequate testing of such large scale, complex systems are expensive and take time. This is related to another factor which affects system success and failure—the difficulty of estimating the time and cost it takes to implement large scale, complex systems. Companies are often not willing, or able, to devote the time needed for successful implementation. Hence, many systems fail after going live too early.

Today, most software is not developed from the ground up. Existing software is usually customized for specific companies' needs. This, too, can cause all sorts of implementation problems, especially with large, complex software.

This paper focuses on applying these concepts of information systems success and failure to a technology that over the last five years has been widely adopted world-wide.

ENTERPRISE RESOURCE PLANNING SYSTEMS—BACKGROUND

Enterprise Resource Planning (ERP) systems were developed in the 1990s to provide a comprehensive and integrated means for the management and operation of an enterprise. ERP systems generally automate and integrate the majority of business processes and share common data and practices across the enterprise.

The scope of ERP encompasses nearly every aspect of an enterprise, but is often categorized in three primary applications: manufacturing and logistics, financing and accounting, and human resources and payroll. ERP allows a real-time summary of all the operations within the enterprise (Grad, 1999).

It is only in recent years that computer and software technologies have been able to support such a comprehensive platform for business operation. It is not surprising that ERP has evolved from more primitive packages that made use of technology available at the time. These earlier software applications resulted in a clutter of various technologies customized for each department that worked effectively within the department, but could not really interact with other departments (Slater, 1999). A need arose for an integrated system that could seamlessly transfer relevant information between the various departments across the entire enterprise. This was the beginning of Enterprise Resource Planning.

The adoption of ERP initially gained momentum through Y2K compliance. Rather than upgrading existing software, many companies moved to the new ERP systems that were already Y2K compliant (Richardson, 1999). However, ERP has the potential to bring many additional and substantial benefits to companies including standardization of computer systems and platform, integration of heretofore disparate business processes and elimination of redundancies within the enterprise, leading to a more efficient and more competitive enterprise. ERP also enables globalization of the enterprise by supporting multi-language and multi-currency environments. Different accounting and legal practices can also be automatically taken into account. For companies in the 1990s seeking growth and globalization, this ability to plan and allocate all resources across the enterprise was just what was needed (Slater, 1999).

ERP IMPLEMENTATION PROBLEMS

Unfortunately, the comprehensive nature of ERP is also the root of its greatest disadvantages. Since ERP integrates operations from the lowest levels of an enterprise to the very top, the implementation of ERP often requires not only a complete reorganization of the company's IT resources, but fundamental changes in corporate culture, business processes and management as well (Schneider, 1999). As a result, implementing ERP has become notorious as a long, costly and painful process, with several high-profile cases of companies canceling their ERP implementations midway after encountering too much difficulty.

One particularly high profile case involved Hershey Foods Corporation. In the Fall of 1999, Hershey, the nation's largest candy maker, was not able to make shipments for Hallowe'en because of the implementation of an SAP based integrated ERP system. This case illustrates many of the factors affecting implementation success discussed earlier. The system was large and complex, costing $110 million. Three different software and computer systems from SAP AG, Manugistics Group, Inc. and Siebel Systems, Inc. had to work together. In such a situation, it is difficult to apportion blame when something goes wrong. SAP said the problems were due to Hershey going on line too early and with a huge piece of it all at once. Hershey blamed the problems on the integration of two different systems. A newly developed system meant to ease shipping and logistics between Hershey plants and retailers was to be integrated with an existing nationwide order-taking and distribution system. According to Hershey, this caused major disruptions. They said the integration of the two systems had not been tested adequately. The problems continued past Hallowe'en, through Christmas and Valentine's day.

This complex and difficult implementation process is one of the greatest issues facing ERP today. One major problem is the coordination of technical and business expertise. Consultants hired to implement an ERP solution may be experts on the software and technology but cannot be expected to know very much about the minute details of the business operations within the company. On the other hand, the companies that implement ERP are often ignorant of the extent and complexity of effective ERP solutions (Deutsch, 1998).

A good illustration of this is another high profile case involving Whirlpool Corp. Whirlpool had to delay shipments of appliances to distributors and retailers. As a result of this delay, Home Depot Inc. stopped ordering appliances from Whirlpool, at least temporarily. Whirlpool blamed the delay on a newly installed ERP system. But SAP said they warned Whirlpool before its system went on line that it had problems generating some supply data fast enough. According to SAP, Whirlpool ignored the cautionary advice and chose to go live anyway.

ERP SUCCESS FACTORS

A study by Benchmarking Partners has identified "Ten Critical Success Factors for ERP Implementation" in which priority, a dedicated team, and clearly defined business and strategic objectives are identified as the most critical factors. Senior management, as a top priority for the company, must take the initiative, with appropriate management bonuses and incentives for successful implementation. Team members must be completely dedicated to the project and removed from other responsibilities, with preferably at least one sponsor in senior management. Finally, the company must identify specific business objectives and plan a phased deployment with repeated tested at each stage, to ensure that things are going in the right direction (Benchmarking Partners, 1999). Other tips identified by similar studies include concurrent employment training for the software with continuous feedback from the end users who will actually use the system and minimum alteration of the standard software package so that future upgrades are easier (Deutsch, 1998; Slater, 1998).

CONCLUSIONS

ERP represents the culmination of three decades of business computer technology with increasing capabilities and complexity. The technology has reached a point where fundamental changes in business methods, strategy and culture are needed. Consulting firms have often concluded that failure of ERP is often the result of insufficient planning, awareness, vision and training, not the result of any fundamental flaws in the ERP technology itself. Indeed, the study by Benchmarking Partners concludes that success has almost nothing to do with technology and almost everything to do with people and process. The future of successful ERP implementation does not rely on further improvements of technology, but on bringing people and business up to speed on the appropriate use of ERP technology to fit their defined business needs and objectives.

The realization that ERP is not a turnkey solution is the first step towards not only solving the implementation problem, but also wider applicability of ERP in different vertical segments. As businesses learn what they want from ERP and to successfully incorporate it into their operations and planning, ERP providers will in turn improve their ability to accommodate different industries and business models.

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INTERESTED IN IMPROVING: YOUR TEACHING, STUDENT PLACEMENT, OPPORTUNITIES FOR APPLIED RESEARCH, PRACTICAL KNOWLEDGE, PROFESSIONAL NETWORK, AND EXTERNAL FINANCIAL OUTREACH?

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ABSTRACT

Interested in Improving: Your Teaching, Student Placement, Opportunities for Applied Research, Practical Knowledge, Professional Network and External Financial Out Reach? Try a Faculty Internship. It is a win-win-win-win opportunity. You win, the faculty member gets many benefits. The company wins, they gain access to your expertise and an inside track for recruiting your best students. Students win, they receive better lectures, great guest speakers, and better advise about career choices. The school wins, you promote your institution by your work, and your school has an inside track on seeking financial or other grants from companies.

INTRODUCTION

One criticism that is often level at the academic community by business leaders is that colleges of business have fallen behind the times and are not "in touch" with current developments (Smith, 1995). In the technology areas some times the opposite accusation is leveled, colleges are investigating the latest and greatest technologies that are ahead of business adoption. In marketing a common perception among practitioners is that theories emanates from the "ivory tower" of academia without a foundation in practice (Nataraajan, Henthorne and LaTour, 1998). Many of these perceptions arise due to the gap between business practices and colleges of business principles.

Many faculty, especially new faculty lack practical experience in there academic field. They have taken the courses that survey their field. They understand all the principles and theories, but lack experience in applying all this knowledge. The common route to this experience in business is consulting. But consulting is somewhat of a catch 22 situation, as you need experience to get the consulting work. If you are lucky you have a faculty colleague willing to share consulting work to help you gain experience. Another approach is a Faculty Internship. Much like a student internship you spend a week, a semester, or the summer working in an organization. This approach has many benefits and few drawbacks. The benefits come to you, the company you work for, as well as to your students and your school.

MY EXPERIENCE AS A FACULTY INTERN

As I faced the dilemma of education, but no experience and being in a small IS department, I realized an internship was a perfect solutions. I could gain some experience, without other faculty assistance. Timing was also on my side. I had just been approached by an IS manager at one of the few companies with a major IS shop in my area (Columbia Gas Transmission) about student internships. When I suggested the idea of me as a faculty intern, he was at first hesitant, but talked it over with his company management and I was in.

There were a few problems on the company side, such as hiring me as an independent contractor. This was solved by going through a local temporary employment agency. I was teaching summer classes, so I need to be able to work around my summer schedule, but this turned out not to be a real problem.

My assignment was to be a project manager on the installation of a new software package for tracking employee software skills and company position needs. The product they purchased is called Skills View from a company in New England. The project required coordination from several departments in the IS side of the business. There were several related projects occurring that were interrelated to the Skills View project, so I had the opportunity to work with several department managers and get an in depth look at what they were doing and how they operated.

Several students from my MIS program were hired as interns, so it was good to have a close look at what they were involved in doing and the skills they were gaining. Most of those interns were offered positions when they graduated. So the student internship program we started worked very well.

I worked most of May and June, then taught all of July and into August. I had only a couple of week available at the end of summer to finish the project. It would have been better to have a continuous block and not had to break it up with teaching.

Overall I would rate my experience as very successful. But there are some thing I would do differently based on my experience and from working with the consultants from Skills View. First, I would have clearly defined the desired outcomes for the project I was working on. I generally knew what was wanted, but specific objectives would have given me more confidence in being successful. This was specially true since I had little experience and no one to mentor or advise me. I would have developed some milestone objectives and a project schedule. Finally, I would have had weekly evaluation sessions with the manager I was working with, learning more from his experience.

LENGTH OF INTERNSHIP

While my experience lasted most of the summer, Friedlob and Trapnell (1988) suggest a Mirco-Intership that last for a few days to a week. So the length may not be the most important factor. Friedlob and Trapnell (1988) suggest several advantages to their micro-internship.

- Cost of faculty member is reduced
- Opportunity to maximize exposer to more areas of the company quickly
- Lower cost to the company
- Hands-on experience can be available to all faculty

SUCCESS FACTOR

Carnes and Gierlasinski (1999) have six suggestions for a company considering a faculty internship program. But the suggestions will work for faculty member as well.

1. Begin on a small scale. Make contact with a local company and see what they need.

2. Match the faculty member's talents with needs of the job. Do they need a special project consultant or a part-time regular employee? Will the intern work with clients or just staff? Do training? Both parties should put the internship into written form.

3. Integrate the intern into the business in a professional manner. Dress code, former students, work hours, etc all need to be detailed.

4. Be flexible in compensation issues. Pay what the project is worth.

5. Conduct a post-internship evaluation. Both intern and company can learn from an objective exit interview.

While this list in not exhaustive, it is a good starting place. Work from here to custom a program to meet your situation and needs.

BENEFITS

Who benefits from faculty internships? Everyone. It can be a win-win-win-win opportunity. Faculty gain insights into current business practices, companies gain access to the professor knowledge and an inside track on students, students have more relevant lectures and an inside track to employers, and college/university win with an inside track on funding opportunities.

FACULTY MEMBERS

Faculty member can see the theories and principles they teach in actions, meet new people and expand their knowledge. Individual benefits include:

1. The opportunity to gain practical experience by working side-by-side with practitioners;
2. The introduction to problems business face that can lead to research ideas;
3. An expanded network of professional contacts;
4. Gain a greater understanding to the skills needed to taught in your curriculum; and
5. Extra income.

As a faculty intern I gained all of these benefits.

COMPANIES

The firms involved have many benefits. The benefits to the firm include:

1. Access to the expertise of academics with current knowledge of the latest technologies and new applications for other technologies.
2. Access to a continuing supply of better educated job candidates and ongoing interactions with potential employees.
3. The use of your company in teaching examples.
4. The opportunity to send guest speakers to promote the firm.

Columbia Gas Transmission has found our students to make excellent employee and actively seeks them.

STUDENTS

Students are the big winner in faculty internships. The benefits to your students are:

1. Lectures filled with practical examples from local companies,
2. Guest speakers with first hand industry knowledge,
3. Faculty contacts that lead to great jobs, and
4. Better advise in career choices.

I feel my students are better prepared and have access to better jobs because of faculty internships.

THE INSTITUTION

The school wins. Once a firm has a relationship with your school they will be sympathetic to your financial needs, such as student scholarships, equipment grants, or other financial grants to your school.

Columbia Gas Transmission has donated over forty PC's to my college of business.

CONCLUSIONS

Faculty internship may not be for everyone, but they are an excellent way for new faculty to gain valuable experience. Companies enjoy a closer tie to the university and new employees. Students have professors with practical knowledge. Institutions have access to outside funding that may not other wise be available.

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DEVELOPING A ROBUST SYSTEM FOR EFFECTIVE TEAMWORK ON LENGTHY, COMPLEX TASKS: AN EMPIRICAL EXPLORATION OF INTERVENTIONS TO INCREASE TEAM EFFECTIVENESS

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> The synergy of informed minds working together is incredible; whereas unprepared minds working together is nothing more than pooled ignorance (Jones, 1996, 87).

ABSTRACT

Management of student teams in information systems courses so that students learn how to participate in teams effectively is an important task for IS professors. However, most research on this topic applies what is learned from student teams to teams in the work world, not to the academic environment. Three professors at two universities in six classes apply interventions to improve student team process in two courses: Database Management Systems, Systems Analysis and Design. Two control groups were used. Results indicate that these interventions make a significant difference, although caution must be used in interpreting the results of this exploration.

INTRODUCTION

Because of the increasing emphasis on teamwork by businesses and subsequently, by higher education, teaching students to work effectively in project teams is an important issue (Gardner and Korth, 1998; McKeague et al, 1999). However, the characteristics of student teams limit the applicability of research on team or group process outside the academic environment (Jones, 1996). A broad ABI Inform search conducted for the most current fifteen years using the search term "student teams listed over 450 articles. However, only six articles during this fifteen-year period dealt with making student teams in an academic environment more effective. Most research used student teams as a surrogate for professional work groups, despite the fact that most student teams operate in a very different context and with a very different level of work experience and domain expertise. A meta-analysis of the literature on effective student teams was conducted to derive a set of interventions with student teams which had improved project team process and/or content learning (Stephens, 2001).

Our interest in ways to make student teams more effective in an academic environment, particularly in information systems classes with term-long projects, arose from our suspicion that teamwork as practiced in academia was serving an opposite from intended purpose. That is, students were learning how *not* to participate in teams effectively. Students tended to procrastinate until the last few weeks of the term and then with the high stress levels experienced then, irritability and conflict in teams increased. Frequently, high achieving students on the team exerted a heroic effort ("all nighter) to complete the project either alone or in pairs. Other students got a free ride and the same grade. The team experience seemed to be decreasing learning and increasing grade inflation as all students received grades earned by the better students. Feedback on the project usually came at the end of the term, but no action was required as a result of this feedback. Instead of learning how to execute a project effectively as part of a team, students seemed to be learning all the "what not to do's for effective teamwork. In fact, we asked ourselves, "would the students enter the work world be better prepared for effective teamwork if they had not had teamwork in the academic environment?

Jones (1996) calls for the development of a robust system for managing student teams, a set of interventions that is not instructor dependent or task dependent as long as the task is a complex one like a term-long systems project. Preliminary results indicate that significant improvements can be made with these interventions and that the results are not dependent on a particular instructor. Thus, we demonstrate progress toward a robust system for effective student teamwork on lengthy, complex tasks such as a systems project.

This paper describes our exploration of guidelines for increasing the effectiveness of student project teams, both in terms of learning course content and learning to work well in teams. First, we review the results of a meta-analysis of prior research (Stephens, 2001) and then we look at our exploration of intervention sets with results obtained thus far (data collection and analysis for three of seven classes is incomplete at this writing). Student surveys and comments, peer evaluations, anecdotal information, and instructor judgment are used for our results analysis. Finally, we make recommendations for interventions based upon prior research and our results. Needs for further research are addressed in our conclusion.

RESEARCH QUESTIONS

Our primary concern is with large, more complex projects that require coordination throughout the academic term. Other than projects, two types of assignments tend to be team activities in information technology courses (Stephens and O'Hara, 1999): research papers and case study analyses. This research does not address these two types of team assignments. We are concerned with tasks, like information systems projects, where groups have been shown to perform better than even the best individual in that group: "the problem has multiple parts, no one member has all the information necessary, the problem is at least moderately complex, interdependence is necessary, and there is enough time for members to process information (Watson, Johnson, Merritt, 1998, 162).

Given projects with these attributes, what interventions will facilitate the following objectives?

increase learning of course content

learn how to work in teams effectively including professional meeting conduct, conflict resolution, peer evaluation, workload sharing, incremental versus last minute development, management of non-performers

improve quality for final project deliverables

increase student and instructor satisfaction with the team experience and the project deliverables

prepare students to participate effectively on project teams in the work environment

We begin our exploration of these questions knowing that the development of these guidelines will be an ongoing process, one of the "holy grails of our pedagogical efforts. However, work over the past two years has been productive.

INTERVENTIONS EMPLOYED

A review of prior research and an analysis of interventions shown to be effective (Stephens, 2001) provides a background for instructor selection of both interventions and timing of interventions.

Tables 2 and 3 provide summary data concerning the classes in which interventions were employed and the intervention sets employed in each class for this empirical study.

TABLE 1
META-ANALYSIS OF PRIOR RESEARCH
INTERVENTIONS FOR IMPROVING EFFECTIVENESS OF STUDENT TEAMS

Interventions	Source(s)
Rapid, frequent feedback on team process (documentation in form of reports, minutes, agendas, action lists, meeting journals) and project content (reports, presentations, project deliverables)	Jones (1996); Watson et al. (1998), McKeague et al. (1999)
Frequent, regularly scheduled meetings	Jones (1996), McKeague et al. (1999), Stephens and Myers (2000)
Training on working in teams	Jones (1996); Mennecke et al. (1998); McKendall (2000), Siciliano (1999)
Individual as well as team accountability	Jones (1996), McKeague et al. (1999)
Peer evaluation	Watson et al. (1998), Roebuck (1998), McKendall (2000), Siciliano (1999), Rajlich et al. (2000), Stephens and Myers (2000)
Team contract	McKendall (2000)
Reflection on team experience	McKendall (2000)
Student evaluation of other team projects	McKendall (2000)
Lessons on importance of teamwork	Gardner and Korth (1998)
Discussions of prior problems with teamwork	Gardner and Korth (1998), Siciliano (1999)
Assign to teams based on learning styles	Gardner and Korth (1998)
Development of ideal team member profile	Siciliano (1999)
Attention to meeting management	Clark (1998), Stephens and Myers (2000)
Weekly scheduled meetings	McKeague et al. (1999), Stephens and Myers (2000)
Meeting time in class	McKendall (2000)
Defined roles in meetings	Clark (1998), Mennecke and Bradley (1997), Stephens and Myers (2000)
Use of meeting agendas	Clark (1998), Stephens and Myers (2000)
Use of meeting minutes, journals	Clark (1998), McKeague et al. (1999), Stephens and Myers (2000)
Team process as grade component	Stephens and Myers (2000)
Meeting management as grade component	McKeague et al. (1999)
Use of e-mail for information sharing prior to meetings	Clark (1998) , Stephens and Myers (2000)
Use of action lists in meeting	Stephens and Myers (2000)

TABLE 2
CLASS DESCRIPTORS

Class	Instructor	Course	University
A	1	Database Management	1
B	2	Database Management	1
C	1	Analysis and Design	2
D	1	Analysis and Design	2
E	3	Analysis and Design	2
F	2	Database Management	1
G	3	Database Management	1

TABLE 3
INTERVENTIONS EMPLOYED IN EACH CLASS

Interventions	A	B	C	D	E	F*	G*
Rapid, frequent feedback on team process (documentation in form of reports, minutes, agendas, action lists, meeting journals) and project content (reports, presentations, project deliverables)			X	X	X	X	X
Frequent, regularly scheduled meetings	X		X	X	X	X	
Training on working in teams				X	X		
Individual as well as team accountability				X	X		
Peer evaluation	X		X	X	X	X	X
Team contract			X	X	X		
Reflection on team experience				X	X		
Student evaluation of other team projects			X	X	X		
Lessons on importance of teamwork				X	X		
Discussions of prior problems with team work	X		X	X	X		
Assign to teams based on learning styles							
Development of ideal team member profile						X	X
Attention to meeting management	X		X	X	X	X	
Weekly scheduled meetings	X		X	X	X	X	
Meeting time in class				X	X	X	X
Defined roles in meetings	X		X	X	X	X	
Use of meeting agendas	X		X	X	X	X	
Use of meeting minutes, journals	X		X	X	X	X	X
Team process as grade component			X	X	X	X	X
Meeting management as grade component				X	X		
Use of e-mail for information sharing prior to meetings	X		X	X	X	X	
Use of action lists in meeting	X		X	X	X	X	

* In Classes F and G, students were allowed to choose to use no interventions or to use the interventions described on a web site. Student teams who chose to use the interventions comprise Class F. Students who chose to use no interventions comprise Class G. The same survey was administered to both groups.

For the continuation of our study (Stephens and Myers, 2000) with Class C, three major changes were made to the treatment for Class A: roles could be assigned for longer durations, a contract was required, and frequent feedback was emphasized with three team presentations instead of the prior final presentation of the project. In Class A, we had required that roles rotate, allowing each team member to play each role. Students in this class (Stephens and Myers, 2000) asked that each team member play each of the three roles (Facilitator, Scribe, Scheduler) then that the roles be assigned for at least three weeks to the same student (see Stephens and Myers, 2000, for a full description of these roles). So we allowed students to take on a role for longer periods of time. Secondly, we required a team contract. The contract must specify

> time and place of the regular weekly meeting;
>
> number of permissible absences and justifiable reasons for absence;
>
> conduct during the meeting;
>
> conditions under which a team member could be terminated from the team;

grade to which the team aspired and time/week willing to devote to the project;

use of e-mail (for example, check e-mail at least once per day, use a certain format for attachments); and

other issues of importance to the group.

We emphasized that teamwork is important in our field and also emphasized that we were expecting professional team management, including the termination of non-performing team members. Schedules were the basis for team assignment. Each class member introduced her/him self to the class and indicated when s/he could meet every week. Team contracts had to be accepted by all team members and by the instructor. Elements of the ideal team member (Sciliano, 1999) were used for the contracts.

Thirdly, instead of one project presentation, Class C made three presentations. At each presentation, the class served as Steering Committee, completing an evaluation form and making recommendations. Teams submitted the project notebook for instructor review. Feedback given became a part of project documentation. Before the next presentation and review, changes recommended by the instructor should be made. These changes become part of the next review. One analysis and design class, Class C, used these team process constraints.

The following term, three modifications were made for Class D.

Additional incentives were added for weekly meetings and for responding to feedback.

Peer evaluation concerning the perceived behavior of each team member was administered at midterm.

Some class time was allotted for team meetings.

Points were given for agendas issued two days prior to the meeting and for minutes distributed within two days after the meeting. A template was used for the agenda and the minutes. Teams might not receive full points if minutes were sketchy or agenda items missing. Any student missing the meeting received no points for either the agenda or minutes, thus extending controls beyond the team itself. To encourage timely response to feedback, the team's track record on looping back to revise or correct project work based on feedback became a component of the project grade. Teams that had not responded to feedback on the first presentation by the second presentation had to meet with the instructor. At midterm, each team member completed a survey on the behaviors of other team members. These were summarized and given to each team member. Further, after midterm, teams were allowed some class time for meeting. Class D, an analysis and design class, used these additional conditions.

Class E used almost the same conditions (no midterm peer evaluation and two versus three milestone presentations) as Class D but had a larger team size on average and had a different instructor. As with Class D, the course content was analysis and design. Classes F and G, database management classes, were given a choice concerning team process. They could use the guidelines posted on the class web site or use very few guidelines. The guidelines for Class G are most like those for Class A with the following exceptions.

Class time was allowed for meeting

Assignment to teams is based on student preference of three methods: no preference (random used), description of ideal team member, list of preferred team members

Feedback in the form of two midterm deliverables

Those students in the two classes who did not choose to use the team process guidelines were called Class G. They did participate in the feedback in the form of two midterm deliverables, class time allowed for meetings, and choosing their preferred method of team assignment. These two intervention sets are especially interesting because the class had both computer science and information systems majors. Additional data for analysis is provided in terms of performance according to choice concerning team process and choice according to major. Furthermore, these classes had a mix of non-traditional and traditional students. Many non-traditional students had work experience with teams, whereas traditional age students lacked such experience.

The same instructor managed the team process in Classes A, C, and D. Another instructor managed the team process in Classes B, F, and G. A third instructor managed the team process in Class E. Instructor 1 managed teams at both University 1 and 2 while Instructor 2 managed teams at University 1 and Instructor 3, at University 2.

RESULTS AND DISCUSSION

As Mennecke and Bradley noted (1997), studies of these types will always have confounded results and are by nature, more exploration than experiment. We examined each of our research questions objectives in terms of both survey results, student comments, and professor judgment. Our objectives for these interventions followed in parenthesis with the survey question numbers (Appendix A) which address that objective are as follows.

increase learning of course content (18,19, comments, professor judgement)

learn how to work in teams effectively including professional meeting conduct, conflict resolution, peer evaluation, workload sharing, incremental versus last minute development, management of non-performers (1-17, 20-26, comments, professor judgment)

improve quality for final project deliverables (7, comments, professor judgement)

increase student and instructor satisfaction with the team experience and the project deliverables (27,28, comments, professor judgment)

prepare students to participate effectively on project teams in the work environment (professor judgment)

Increased Learning

All student groups agreed that the project helped them to understand course topics, with the strongest agreement being from students who had points given for weekly team meetings (Appendix B). Surprisingly, students were indifferent about whether the project helped with exams except for students who had grade incentives for weekly meetings (D and E) and they agreed that the project helped them with the exams. In fact, the most frequent rating for that statement was a mode of 5 or strongly agree between those two groups. The intervention that made a difference with learning course content was to provide a grade incentive for weekly meetings, as demonstrated by meeting minutes and action lists submitted weekly. Professors involved also judged that background readings were completed on a week-to-week because the readings were needed to complete incremental project deliverables.

Working in Teams Effectively

The use of agendas, meeting minutes templates, action lists, and designated roles all contributed to professional meeting conduct. All students, including the control and those who chose not to use constraints, agreed that they learned to use meeting time more effectively as a result of the project. All but one of the treatment groups agreed that agendas were valuable and contributed to effective use of meeting time. All groups agreed that action lists were valuable and contributed to equitable workloads. The strongest agreement came from the groups that were rewarded for weekly meetings (D,E). Peer evaluations at midterm seemed to be an effective intervention. Group D had a more favorable experience overall than other groups and was the only one with this intervention. Group D also dismissed one student from a team for contract violation. The effect of midterm evaluation needs further exploration based on these results. Peer evaluations at the end of the quarter did not result in grade changes for any individual student because they indicated that individual contributions had been reasonably equitable. Professors judge that action list monitoring, contracts, and weekly meetings positively affect workload sharing. Results on the use of roles are mixed. The facilitator role was found most valuable and teams with regular weekly meetings agreed that the scribe and scheduler were valuable. The weaker results for the scheduler may indicate that more class time needs to be devoted to this role's duties.

One of the most important results of the interventions experienced by groups C,D, and E was the requirement that deliverables be presented throughout the quarter. Results indicate that an incentive for weekly meetings and increased use of feedback along with the use of roles and meeting management, improves the project and the project experience (Class D,E,A). The deliverables for the project are nearly complete at the same time in the term as the project was typically begun without these interventions. Almost all members of the team participate in the project substantially or are terminated by their team, in keeping with the terms of the team contract. After implementation of the contract and rewarded weekly meetings (Class D and E), teams actually terminated members, as happens in the "real world. Thus, two key problems have been addressed: procrastination and free loading. All groups agreed that their skill at working in groups had improved, but treatment groups D and E, where weekly meetings were part of the grade, experienced strong agreement with this statement.

Project Quality

Professors judged that the quality of the final project was significantly improved as a result of incremental team development. Using grades as an indicant of quality has proved difficult since grades tend to be relative to overall class performance. With incremental presentations, the expectation for the final project may shift as well. Students perceive that the quality of the project is improved as a result of team activity in all groups, but the strongest agreement is found in groups where team process interventions were employed, so student perception agrees with the professors' perception on improved project quality.

Satisfaction with the Team Experience

Student satisfaction with the team process improves with increased interventions and decreases with less structure or a lower level of interventions. The lowest satisfaction with the team project was experienced by Class B, a control team with the fewest interventions, and the next lowest, by Class G, students who had some interventions but who chose to not follow team process guidelines. The students with the highest level of interventions, Class D, experienced the highest satisfaction (Appendix B). All teams using a contract strongly agreed with the statement in question 27, "The project team worked more effectively with the constraints concerning meetings and roles played than other teams on which I have worked which had no team process constraints. Teams with follow-up (whether rewarded or not) on regular weekly meetings strongly agreed with the statement, "I would choose the same team members again.

When Students Choose

The results with Classes F and G, where students chose whether to use team process interventions, are particularly interesting. While class B was a control class, students in the F group chose not to employ team process constraints. Highlights of these results follow.

> 36% of the students chose to use the prescribed team process (intervention set F). They were not given any encouragement from the instructor. The guidelines were simply available to students as a link off the web page describing the team project.

CS majors were evenly split between interventions F and G. IS majors were less likely to choose to use the team process (intervention F) only 24% of IS majors made this choice.

Students with intervention set F were more likely to be employed full or part time, perhaps because they have a more mature understanding of the power of teams when run effectively.
Students with intervention F were more likely to comment about increased team effectiveness related to minutes and action lists, though minutes were required of all students.

Students (F and G) recognize the effectiveness of regular, well-planned meetings, but are loath to take time outside of class.

Several teams expressed frustration with students who contributed very little, procrastinated until the last minute, or simply had lower grade expectations.

Many suggested that the derelict students be handled more formally, although an end-of-term peer evaluation accounted for 25% of the project grade. A few suggested the use of contracts. These comments originated with students involved in both interventions F and G.

Students with intervention F more frequently expressed satisfaction with the use of email and phone calls as a way to address differing schedules.

Students with intervention G more frequently expressed a need for more detailed guidelines (!).

Even students with extensive work experience express frustration about covering for the slackers in order to delivery a high quality project.

One student expressed concern over the distribution of international students felt that his/her team contained too many international students which generated communication problems.

One student expressed concern over the gender distribution of her team she was the only female.

At the beginning of the term all students were asked for "team preferences in an on-line survey. The instructor attempted to use these requests to meet students' perceived needs. At the end of the team process, several students mentioned the importance of choosing their own teammates, most especially students in treatment G. It is interesting to note that students with very specific ideas of who to work with were more likely to choose to follow treatment F (team guidelines).

Also students who initially described the ideal team member using phrases like "achievers or "[students] who work hard were placed on teams together. At the end of the process, they were generally the most dissatisfied with the experience. Perhaps, students accustomed to star performers carrying the group, selected each other with this preference. The link between ideal team member definition and project outcomes bears further investigation.

Students with some work experience are more likely to choose to follow a structured approach to teamwork. Therefore, it may be more important to required adherence to the team process when students have little personal experience with the world of work.

Instructor 2 will experiment with contracts in the future.

Instructor 2 will explore assigning student to teams based on work styles or habits, as with the Myers-Briggs instrument or similar.

CONCLUSIONS AND FURTHER RESEARCH

Our experience in the initial study involving Classes A and B, as well as this continuation with five more classes, leads us to believe that student team projects can teach effective teamwork and better prepare students for a team environment in the work world. Student teams can reinforce the learning of course content for all students, not just the stars who have been carrying the load for most student team projects.

Two interventions appear to be critical.

Weekly meetings as evidenced by meeting agendas, minutes, action lists submitted for grading purposes. Any absent student receives no points.

Milestone presentations throughout the quarter timed to follow the topics currently being studied. Student teams receive feedback from peers and the professor.

Our results are encouraging. Although much work remains to be done, we conclude that it is possible to dramatically increase learning, student team effectiveness, and both student and instructor satisfaction with the experience when team process interventions are employed. A phased approach may be used (Stephens, 2001). These interventions allow student teams to more accurately simulate the experience of professional business teams, thus better preparing our students for role on these teams in the work world.

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APPENDIX A
SURVEY

Project Team Evaluation Name ______________________________

Part 1: *Using the following scale, please evaluate the following statements. Please mark the accompanying scantron form. Please record your name on the scantron form as well as this form.*

A. Strongly Agree B. Agree C. Indifferent D. Disagree E. Strongly Disagree

1. I like to work on a project team.
2. I like to work alone.
3. I prefer to do project work alone.
4. I prefer to do project work as a member of a team.
5. Projects take more time if completed as a team activity rather than as an individual activity.
6. Projects take less time if completed as a team activity rather than as an individual activity.
7. Project quality is improved if the project is a team activity.
8. Establishing a weekly meeting time helped the team to work on the project throughout the semester instead of as a "last minute endeavor.
9. Publishing an agenda for each meeting was valuable.
10. Publishing an agenda for each meeting caused us to use meeting time more effectively.
11. Creating an action list was valuable.
12. Creating an action list helped us to stay organized.
13. Creating an action list helped us to make sure everyone did his or her "fair share.
14. Recording and publishing the minutes of meetings was valuable.
15. Recording and publishing the minutes of meetings improved communication.
16. I learned how to use meeting time more effectively.
17. My skill at working on teams has improved as a result of this experience.
18. The project helped me to better understand topics and problems in the course.
19. My participation on the project team will helped or will help me with the exam(s).
20. Playing the role of facilitator was valuable to me.
21. Playing the role of scribe was valuable to me.
22. Playing the role of scheduler was valuable to me.
23. Having a designated scheduler, scribe, and facilitator improved the team process.
24. Having a designated scheduler improved the team process.
25. Having a designated scribe improved the team process.
26. Having a designated facilitator improved the team process.
27. The project team worked more effectively with the constraints concerning meetings and roles played than other teams on which I have worked which had no team process constraints.
28. I would choose the same team members again.

APPENDIX B
RESULTS FROM SURVEY
AVERAGE, MODE, STANDARD DEVIATION

(Please reference APPENDIX A for question numbers and TABLES 2 AND 3 for interventions)

Set	A			B			C			D			E			F			G		
Q#	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***	***Avg***	***M***	***SD***
1	3.76	4	0.94	3.80	4	1.16	3.92	4	0.91	3.93	4	1.22	4.16	4	0.91	4.32	5	0.84	3.83	5	1.18
2	3.33	3	0.8	3.60	3	1.1	3.68	4	0.99	3.36	4	1.14	3.44	3	0.99	3.45	4	0.96	3.43	4	1.07
3	2.67	3	0.91	3.20	5	1.37	3.08	3	1.12	2.71	3	0.92	2.76	2	1.17	2.55	3	0.96	2.86	4	1.24
4	3.86	5	1.01	3.50	4	1.25	3.88	4	0.88	3.93	4	1.21	3.96	4	0.93	4.00	5	0.93	3.86	4	0.97
5	3.05	2	1.36	3.10	2	1.45	3	2	1.22	2.93	2	7.53	2.84	2	1.34	2.82	2	1.26	3.14	4	1.35
6	3.38	4	1.36	3.10	5	1.47	3.6	4	0.96	6	4	0.63	3.40	4	1.33	3.32	4	1.04	3.31	2	1.32
7	4.1	5	1.02	3.93	4	1.14	4.28	5	0.74	4.64	5	0.27	4.29	4	0.61	4.09	4	0.81	3.97	4	0.95
8	4.43	5	0.68				4.16	5	1.07	4.93	5	0.73	4.56	5	0.80						
9	3.67	4	1.06				3.2	4	1.26	4.29	5	0.73	3.82	4	0.87						
10	3.76	4	1.09				3.2	4	1.32	4.07	4	0.65	3.71	4	0.85						
11	4.14	4	0.91				3.52	3	1.16	4.50	5	0.74	4.02	4	0.68						
12	4.29	5	0.85				3.64	4	1.04	4.36	5	0.77	4.24	4	0.67						
13	3.71	3	1.1				3.52	4	1.19	4.14	4	1.02	3.73	4	0.90						
14	3.62	4	1.2				3.16	4	1.28	3.57	4	1.07	3.42	4	0.90						
15	3.52	5	1.29				3.08	3	1.22	3.71	4	0.76	3.49	4	0.93						
16	3.9	4	0.94	3.83	4	0.95	3.88	4	0.78	4.43	5	0.84	4.11	4	0.76	4	4	0.69	4.03	4	0.73
17	3.9	4	1.09	3.83	4	0.93	3.64	4	0.95	4.64	5	0.63	4.49	5	0.62	4.23	4	0.69	3.91	5	0.98
18	4.38	4	0.59	3.97	4	1.16	3.72	4	1.14	4.64	5	1.33	4.56	5	0.77	4.50	5	0.51	4.47	5	0.61
19	3.33	3	1.02	3.3	3	1.12	3.36	4	1.25	4.07	5	0.80	4.20	5	1.05	3.36	4	0.95	3.11	3	1.05
20	3.52	4	0.98				3.6	3	1.15	4.21	5	0.78	3.91	4	0.86						
21	3.43	3	0.98				3.32	3	1.07	4	4	0.73	3.87	4	0.97						
22	3.29	3	0.9				3.2	3	1.04	3.93	4	0.97	3.80	4	0.92						
23	4.14	4	0.73				3.4	4	1.32	4.21	5	0.92	4.04	4	1.04						
24	3.52	4	0.93				3.24	3	1.23	3.93	3	0.89	3.80	4	1.15						
25	3.71	4	0.96				3.28	3	1.28	4.21	5	0.83	3.84	4	1.08						
26	3.95	4	0.74				3.6	4	1.19	4.29	5	0.65	4.00	4	0.91						
27	3.86	4	0.73				3.44	5	1.39	4.43	5	1.09	4.29	5	0.78						
28	4.19	5	1.17	3.24	5	1.41	4.4	5	1.15	4.50	5	2.73	4.33	5	1.03	3.82	4.00	1.10	3.69	5	1.32

THE MFC FRAMEWORK AS A CASE STUDY OF OBJECT-ORIENTED DESIGN

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INTRODUCTION

In our "Graphical User Interface (GUI) Design" class, we use the MFC application framework (that is, the core of Visual C++) as a development tool. MFC not only is a powerful tool, but also offers a lot of educational benefits. Students, as they use the tool, learn design principles (such as "separation of concerns"), object-oriented application frameworks, common software architectures, and industrial coding standards. However, considerable effort must be made to teach the framework, which often diverts much attention from the primary course objectives.

We use the MFC framework as a case study in the "GUI Design" class, which enables us to introduce features of MFC that students need to know in order to use it effectively, and also provides a context for teaching effective object-oriented design. Our experience shows that this approach gives students a unique learning experience while still allowing us to achieve our course objectives.

OUR APPROACH

Successful application frameworks are full of design patterns [1]. Examples of design patterns found in MFC can serve as a basis for our lecture. UML [2] provides a notation to visualize object-oriented design techniques and makes it easy to deliver.

We identify examples of design pattems in MFC and document them in UML (Unified Modeling Language). Then we organize and present our course material around basic design issues for GUI applications. Examples of design patterns found in MFC are used to facilitate our lecture. Although our primary consideration is software design, we make sure students will gain adequate knowledge about the framework and be able to use it in a professional fashion.

DESIGN ISSUES

Our goals are twofold, teaching object-oriented design for GUI applications and helping students understand the MFC framework. We emphasize on effective object-oriented design in the context of the MFC framework.

We use several well-known design patterns [3, 4] to cover issues including Model-View Separation, Extensibility, Visibility between Objects, Navigability within Windows, and Persistent Objects.

OBSERVATIONS

We have taught the "GUI Design" class for four semesters. We treated the two course elements, object-oriented design and use of the tool, as separate ones in the first two semesters and then took the above-mentioned approach. Consistently giving a comprehensive project of the same type allows us to compare this approach with our earlier experience.

We evaluate students' projects according to the user interface design, functionality, and object-oriented structure. We found that 14 out of 21 students in the second semester had successfully completed their projects, 13 out of 18 in the third, and 15 out of 19 in the fourth. A noticeable improvement was made due to this approach. Note that there was no comparable data in the first semester.

Our approach helped students form a big picture about the MFC framework. As a result, students could handle other details themselves, allowing us to stay focused on more important topics. Students still spent a lot of time searching solutions to certain design and implementation problems. We believe it is a useful experience for students.

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THE TRIALS AND TRIBULATIONS OF UPDATING AN IS CURRICULUM

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ABSTRACT

The rapid and continual changes in computer technology necessitate the adaptation of curricular offerings in computer-related educational programs to provide students with the current skills and knowledge needed by today's organizations. The review and modifications involved in this process can present a challenging task for an academic program. At the University of North Florida, a group of faculty members, instructors, and advisors from the Department of Computer and Information Sciences conducted a comprehensive review of the Information Sciences and Systems (IS) Program to evaluate the program's structure, prerequisites, and course content. Over the period of a year, the review process and subsequent recommendations involved continual meetings, "spirited" discussions, and persistent emails that resulted in curriculum changes which updated both the courses and the program structure. The integration of the changes into the IS Program continues to require the acceptance and support of administrators, teachers, students, and technicians.

EXPERIENCES IN UPDATING AN IS CURRICULUM

In the initial meetings, the often heated discussions to determine the preliminary groundwork brought with it the ominous realization that there would be many challenges in resolving issues that involved potential change. Some of the parameters, such as IS'97 and ISCC'99, provided flexible guidelines for evaluation, while others, such as the Florida common course numbering system, comparisons of courses transferred from other educational institutions, and state educational requirements, caused more rigidity. Additional considerations, such as faculty strengths, domino effect on other courses, appropriate use of technology, and programming languages, that affected the strategies for revision were more subjective, eliciting a wide variety of ideas, concerns, and opinions as well as varying degrees of agreement or disagreement. The first course assessment resulted in an insidious loop that revolved around expansion of course content, state mandated course guidelines, and transfer students which took an inordinate amount of meeting time. It did prove to be a turning point in the discussions by changing the focus of the meetings more toward the structure of the program and general course content instead of the minuscule details of each individual course. This dramatically improved the productivity of the meetings and decreased the intensity of ownership issues on particular courses.

The primary structural changes recommended were to replace Introduction to C with Introduction to Object Oriented Programming (OOP) and to modify the prerequisite courses to support a traditional path (introduction to programming and file structures) and an object oriented path (introduction to OOP and data structures using OOP) with both required prior to the database course. The group reviewed the content of each course and made adjustments to capture the necessary concepts as well as to ensure that the foundations were adequate for the succeeding courses. The approval of the recommendations did not mark the end of the revision process; it was the beginning of more changes that involved faculty, software, and student adjustments to facilitate the adoption of the modifications. The course content recommendations needed to be disseminated to affected faculty members, instructors, and adjuncts who then had to adapt to the new course and the changes in existing courses. Computer facilities needed to provide the hardware and software to support the course requirements. Advisors guided students through written notifications, course adjustments, and curriculum counseling during the transition phase. Administrative support has been and continues to be essential for all areas affected by the program revisions and for the encouragement of further reviews.

Overall, the responses to the curriculum changes have been positive from students and faculty. The addition of OOP has revitalized other courses by enabling new concepts and applications to be utilized. At the beginning of the meetings, some members expected wide sweeping changes and others hoped for a more conservative approach with the final result somewhere in the middle. The recommendations were aimed preparing the IS students with the foundations and skills required by prospective employers and businesses. The assessment process needs to be ongoing to evaluate the effectiveness of the revisions and to continue the process of essential changes for the enhancement of the IS Program.

THE EMPLOYMENT OUTLOOK FOR INFORMATION TECHNOLOGY WORKERS: A DEMAND FORECAST

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EXTENDED ABSTRACT

In the past few years demand for IT workers has experienced tremendous growth. This is the result of several factors, the major ones include Y2K and the eruption of the internet and dot com's. The current demise of dot com's may have eased the growing crisis, but it will return. On the supply side, the US has two basic sources for IT professionals: education or immigration. The US government controls immigration and state governments to a large extent control education. The shortage of IT workers may have a significant impact on the US and local economic activity since most of the productivity growth experienced in the US in the past decade has been information technology driven. If the shortage of IT workers continues, it may have a stifling effect on economic growth. Much IT development is going offshore as local IT professionals are not available to do the work. Governmental policies may need to be changed to encourage more educational opportunities for potential IT workers.

Three main questions need will be addressed. What is the size of the IT workforce? What is its growth rate? How does the lack of IT workers effect economic productivity?

SIZE AND GROWTH RATE OF IT WORKFORCE

There are several sources and estimates of the number of IT workers. The US department of Labor says there are 2,347,030 Computer Occupations in the US in 1999 and projects the number will grow to 3,050,000 by the year 2008. General employment number by major IT manufacturers can be used as a surrogate. Chart 1 shows the monthly growth in Computer and Data Processing Services Workers between 1972 and 2001. This is base on SIC = 737.

Chart 2 shows the growth in the average weekly earnings for these workers during the same period.

Regardless of the source there is clearly an increase in the number of IT workers over the past 30 years. With a dramatic acceleration in the growth rate starting in 1995. Two factors have been driving this growth, the Internet and Y2K. With Y2K behind us and a slow down in the growth of the Internet, will we continue to see this high rate of growth in IT workers? The US Department of Labor predicts a continued high growth rate.

HOW DOES THE LACK OF IT WORKERS EFFECT ECONOMIC PRODUCTIVITY?

This growth rate has lead to a shortage in IT workers. What is the effect of this shortage on the economy? Many economists have contributed the economic growth of the 1990's to productivity gains from the use of IT. If this is true, then the lack of IT workers should have a stifling effect on the economy. We currently are seeing a slow down in the economy, is this the cause?

CHART 1
COMPUTER AND DATA PROCESSING SERVICES WORKERS BETWEEN 1972 AND 2001

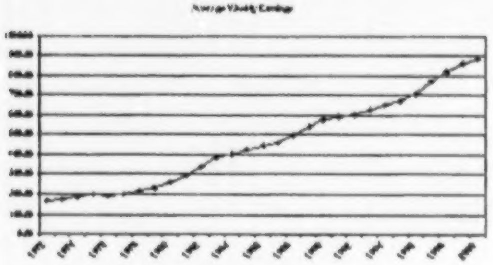
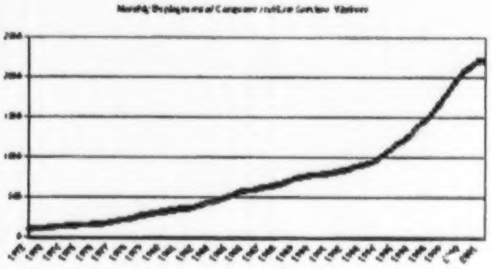


CHART 2
AVERAGE WEEKLY EARNINGS



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AN APPROACH TO TEACHING INFORMATION TECHNOLOGY AND SYSTEM ARCHITECTURES

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Extended Abstract

This contribution deals with an approach to teaching information technology (IT) and system architectures that integrate the theory and practice using a real-world case study. The rationale of the approach is that an IT architecture should be designed in terms of an architecture framework that relates the organizational and IT resources, thereby enhancing the organization's strategic decision-making capability and ability to leverage the organization's competitive position. Business drivers and initiatives are translated to IT requirements and guidelines for the acquisition and deployment of IT's.

The concepts of systems architecting are applied to a case study undertaken in team mode, with the teams modeling the application, data and physical infrastructure perspectives, respectively. The case study described new enhancements to an E-Business System that each team had to analyze and model within the context of their viewpoint.

The architecting framework that is used is the Index Model. The architecting process is a staged model that allows for iteration and incremental enhancement of the models. The architecting methodology, based on the architecting process model, was defined in terms of a series of steps that are followed by each of the project teams. Modeling was performed using appropriate notations to design the systems at various levels of abstraction. The resulting IT and system architectures are documented by the project teams following the EAB architecting documentation method, and the deliverables are presented to the class and project sponsors on completion of the project. Various industry standards are relevant to the syllabus for such a course.

Following upon teaching the course the outcomes have been recorded in terms of the course goal and objectives. The approach was followed for a three credit hour elective in a Master of Science in Computer and Information Systems (Software Management) Program offered in the College of Business Administration at the University of Detroit Mercy.

THE INTERNET AND INTELLECTUAL PROPERTY RIGHTS: WHAT BUSINESS MANAGERS AND BUSINESS MAJORS NEED TO KNOW

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Laurette D. Mulry
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ABSTRACT

MBA candidates need to understand the connection between an increased use of the Web by companies and intellectual property rights. Business students must be ever mindful of these rights given the precarious legal implications inherent in Internet-driven enterprise. Corporations, as well as writers, scholars and artists, want to reap economic benefits from the intellectual property that they create, whether in real space or cyberspace. There is an increased willingness of the nation's judiciary to use the constraints of intellectual property law to send a message to those who are using emerging technologies that intellectual property rights are alive and well in the digital era. This paper focuses on intellectual property policy and its effect on business modalities in light of the explosion of the Web. Intellectual property rights such as copyright, trademark and patent are defined and discussed with an emphasis on what the business manager (and the aspiring business manager) need to know before adopting new technologies or implementing proprietary systems.

INTRODUCTION

The legal landscape with regard to the Internet is a vast, uncharted territory which has been likened to the Wild West (Gruley and Simpson, 2000). While many are wrestling with this brave new on-line world, lawmakers have been reluctant to regulate the Web, opting instead to allow Internet technology to develop unhampered. In this laissez faire environment, it is argued that creativity may flourish and society as a whole may become the ultimate beneficiary (Bessen and Maksin, 1997). Such reticence to act may be predicated upon a willingness to promote the free flow of information that has been the hallmark of the Internet.

Businesses are struggling to cope with the fast-paced evolution of technology where the law is not yet fully developed to deal with such issues as privacy, taxation and the use of copyright laws in the digital era. Indeed, the Internet has fast pervaded every facet of life from communications with loved ones to business-to-business transactions in far-flung locales. Traditional laws are being applied in new ways to deal with these issues of first impression. Legal questions involving e-mail in the workplace, Web content, and domain name protection are finding their way into our nation's courts with little or no legal precedent.

As information systems evolve and new technologies change the way we do business on a daily basis, the business manager must be wary of the possible infringement of intellectual property rights as he or she uses and disseminates information. This idea of emerging technologies as property that is owned and protected by law must be taught to the MBA candidate to foster a respect for the protection of copyrights, which is a basic facet of free enterprise and creative society. Students must be made aware that newly evolving technologies are copyright, trademark, or patent-worthy and thus carry significant legal ramifications requiring licensing.

INTELLECTUAL PROPERTY

Intellectual property policy is based on the desire to give incentives to authors and inventors to create new ideas as balanced against the desire for society to benefit from the dissemination of those ideas (Bessen and Maskin, 1997). Intellectual property is an intangible creation that is legally protected, just as one's ownership of real (land) or personal (i.e., car) property is protected by the law (Sartori, 2000). Intellectual property represents the creative ideas that give businesses a competitive advantage (Bush, 2000). Although the Internet makes it very easy to copy information, businesses that have invested great resources want to protect their investment. There are actually four types of intellectual property: copyrights, trademarks, patents, and trade secrets.

COPYRIGHTS

Copyright law is derived from the United States Constitution (Article I, Section 8, Clause 8). The Copyright Act of 1976, which is the current copyright law in this country, protects original and creative works that are fixed in a tangible medium of expression. In short, copyright protects creative expression such as literary works, musical works, dramatic works, pantomimes and choreographic works, pictorial, graphic and sculptural works, motion pictures and other audiovisual works, sound recordings and architectural works (Sartori, 2000). Copyright does not protect facts, ideas, procedures and methods which are covered under patents, nor does it cover titles, names or slogans which can be afforded trademark protection.

Authors and inventors primarily benefit from a registered copyright. Copyright protection begins at the moment the original work is created and "fixed" in a perceptible medium, and endures for a period of the life of the author plus seventy years. A copyright affords the owner a bundle of valuable and exclusive rights including the right to copy the work and the right to distribute it. Any interference with these rights, such as the unauthorized or without consent use of the copyrighted expression, constitutes infringement for which the law imposes substantial penalties. The Internet has encouraged the desire of individuals for content such as text, images and music. This in turn has increased copyright violations (Joss, 2000). Content companies would like copyright laws to be strengthened so that they have greater control over electronic distribution (Bowman and Borland, 2001).

TRADEMARKS

A trademark, by contrast, is defined as a word, name, symbol or device, or combination of these that serves to identify the source of products or services and to distinguish then from the products or services of others. Therefore, a trademark is a brand name which is used to distinguish one company's product from that of a competitor (Saunders, 2000). Unlike the duration of copyright, trademark protection only lasts for as long as it is in actual use. Typical trademarks include word marks (Bayer), symbols, (Nike swoosh), numbers (Boeing "747"), colors (Owens Corning "pink" insulation), and sounds (NBC chime). To enforce a trademark, one must (1) prove ownership of a valid trademark, and (2) prove that the user's actions are likely to cause confusion and/or dilute the strength of the brand name (Saunders, 2000).

Trademark issues arise on the Internet when unauthorized references to existing trademarks are made in domain names. So called "cybersquatters" commit a form of cyberpiracy when, in bad faith, they seek to "use an Internet domain name that is identical or confusingly similar to the trademark," (Gollin, 2000) or is "dilutive of another's famous trademark" (Satterthwaite, 2000). On November 29, 1999, President Clinton signed the Intellectual Property and Communications Omnibus Reform Act of 1999 which allows a trademark owner to seek relief under the section entitled "Anticybersquatting Consumer Protection Act." One example of the magnitude of this problem is that of the Porsche brand of products. At any one point in time there are over 100 unauthorized references to the trademark "Porsche" in domain names. Recently, the International Olympic Committee dealt with the cybersquatting problem (Barringer, 2000). Two months before the

Games began in Sydney, the IOC filed a lawsuit against 1800 cybersquatters who had registered domain names using terms owned by the IOC. The task of defending a brand name to prevent its dilution is a daunting one indeed. To protect its intellectual property rights, the IOC hired 20 private Web monitors on three continents to monitor possible violations.

PATENT PROTECTION

While copyright protects "creative expression" and trademark protects "brand names/symbols," a patent protects the underlying "ideas" and "inventions." As defined by Black's Law Dictionary, a patent is a "grant of a right to exclude others from the making, using or selling of an invention during a specified time; it constitutes a legitimate monopoly." A U.S. patent does not provide the right to practice an invention, Rather it provides the right to exclude others from making, using, selling, etc. one's invention. This exclusive right endures for twenty years from the filing of the patent with the Patent Office.

Recent changes in the Patent Office Guidelines and in case law have paved the way for an opening of the floodgates for the patenting of computer and software inventions. In 1996, the U.S. Patent and Trademark Office issued its "Guidelines for Computer-Implemented Inventions" which made e-commerce, Internet and business inventions eligible subject matter for U.S. patents (Sartori, 2000). Prior to this time the patent office was not receptive to the patenting of computer-related inventions. Indeed, e-commerce patents are "one of the fastest growing arenas for patent protection in the United States" (Gollin, 2000).

A recent Federal Circuit Court decision further extends patent protection in the Internet field. In *State Street Bank & Trust Co. v. Signature Financial Group Inc.*, (149 F.3d 1368 (Fed. Cir. 1998)), the Federal Circuit reaffirmed the ability to patent computer-related inventions and first announced that business methods are suitable patent material. As such, a patent may be obtained for an invention in e-commerce like a new method of marketing or distribution over the Internet. This is extremely important for the business community as new ways of doing business in the digital world are being created daily, like UPS' package tracking technology which has redefined the package delivery business (Laudon and Laudon, 2000). Business managers should take note of the intellectual property rights that may be available to the business enterprise and should be wary of infringement activity (Sartori, 2000).

RECENT LEGISLATION

Fueled by the new-found politicism of some of the dot-com companies, new legislation has emerged to deal with the volatile, digital electronic environment (Gruley and Simpson, 2000). The Digital Millennium Copyright Act [hereinafter "DMCA"] was passed in 1998 and provides strong copyright protections to deal with the issue of infringement in cyberspace. "The DMCA was intended by Congress to facilitate the robust development and world-wide expansion of electronic commerce and communications over the Internet." (Senate Report no. 190, 105th Congress, 2nd Session, 1998). The speedy passage of the DMCA was seen as a joint affirmation by Congress and the President of the importance of copyright law in the electronic marketplace.

An important provision of the DMCA is the "Safe Harbor" provision which serves to protect Internet service providers and limit their liability for the mere transmission of material through its system or network. It is arguable then that Congress intended with this provision to shield ISP's from the bulk of copyright compliance and thus place the obligation of compliance on the end user of the service.

Another provision of the DMCA that has direct application to the Internet is that of "Fair Use." This is a defense to a finding of copyright infringement that asserts that the use is fair and acceptable. It is loosely based on the Constitutional right of free speech as protected by the First Amendment. To judge whether the use is "fair" within the marketplace of ideas, courts will look at four factors as follows: (1) the purpose and character of the use (i.e. commercial, non-profit); (2) the nature of the copyrighted work (factual works get less protection than creative works); (3) the amount taken in relation to the whole; and, (4) the effect of the use on the potential market for the copyrighted work.

The European Union is attempting to draft similar legislation to the DCMA. The European Copyright Directive hopes to establish the rights of individuals who want to create, produce, sell, transmit or use something protected by copyright in a digital environment (Mitchener, 2001).

CONCLUSIONS

Companies need to be aware of the demands of existing law. Indeed, "many businesses do not even realize that they are creating or using copyrighted works on a regular basis." (Saunders, 2000). The business manager should also be made aware of changes to existing law that affect their information systems or licensed properties. New legislation such as the DMCA should not be ignored. Tremendous opportunities and great risks abound.

Arguments can be made for both positions; for increased regulation in the Internet industry and for unhampered freedom of expression. Certainly the United States Constitution protects the concerns of each side. The law has yet to fully develop in the area of the Internet.

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SYSTEMS DEVELOPMENT PRACTICES: CIRCA 2001

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Extended Abstract

In dynamic computing affiliated disciplines it is critical for schools to periodically re-evaluate their curricular offerings in order to produces graduates who possess relevant knowledge, skills, and abilities (KSA). As an applied discipline information systems programs need to align their curricular offerings with the current and future needs of industry. To this purpose, university IS programs seek ongoing curricular guidance from industry constituencies, from professional organizations such as the Association of Computing Machinery (ACM), the Association of Information Technology Professionals, and others. These efforts have resulted in curricular guidelines such as IS'97 (Davis, 1997) and ISCC'99 (Lidtke, 1999), and has also served as input toward pending accreditation efforts (Gorgone 99).

While generalized curricular models provide welcome guidance in specifying which knowledge, skills, and abilities (KSA) are generally important, it is incumbent upon individual programs to adapt these recommendations based on regional needs and changing State-of-the-Art and State-of-the-Practice methods.

Rapid change within the computing industry and in the software development arena suggests IS programs should assess which development methods, techniques, and tools are practiced currently and within the foreseeable future. Recent research (Tang, 2000) reports system development methods to rank high in requisite proficiency level, and using empirical support suggests student achievement is deficient regarding knowledge of software development methods. Yet the referenced research used a macro level of granularity and provides no elaboration concerning which development methods are important and which have insufficient student achievement. Similarly, industry publications (such as Computerworld, 2000) regularly report on hot programming skills and tools yet they rarely specify areas comprising important development methods and modeling techniques. Importantly, shifting development paradigms, such as from structured to object oriented methods, requires substantial curricular change in the emphasized KSAs related to development methods and modeling techniques. Whereas anecdotal evidence, a desire to be "leading edge," and input from particular industry partners has convinced some programs to transition from structured to object oriented foci, other programs are seeking empirical evidence to support their decisions regarding which modeling techniques to emphasize. Knowing which techniques are currently used (state-of-the-practice) and will likely be used in the future (state-of-the-art) would enable programs to make more informed decisions regarding paradigm transitions and which techniques to emphasize within their chosen development paradigm.

Although there is an abundance of anecdotal claims suggesting movement toward object oriented approaches and the emergent Unified Modeling Language (UML) modeling notation, there is a dearth of empirical evidence regarding which analysis and design methods and modeling techniques are currently applied to software development projects. To date, empirical research concerning state-of-the-practice development techniques does not suggest industry adoption of the object oriented development paradigm (Glass, 1999). In addition to current practices it is important to also investigate anticipated transitions, thus preparing students for which techniques will be applied to real-world modeling projects within the foreseeable future. Such empirical evidence is needed if faculty are to make informed decisions regarding which techniques to emphasize in IS curricula.

The purpose of the current study is to empirically assess the extent to which particular development methodologies (SASD vs. OO), techniques and tools are currently practiced and to assess practitioner perceptions of method usefulness and their expectations regarding future use.

The target sample for the study is project managers. Questionnaire based surveys are being conducted to assess degree of methodology, technique, and tool usage and perceived usefulness on their current and foreseeable projects.

Descriptive statistics will be employed to rank perceived usage and usefulness of various modeling tools (e.g., ERwin vs. Rational Rose) and techniques (e.g., Entity Relationship Diagram vs. Class Diagram) and to forecast anticipated changes in usage patterns.

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CHANGING TRENDS IN CORPORATE EDUCATION: IMPACTING UNIVERSITY EDUCATION?

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Extended Abstract

In today's technology-based industry the need to be competitive is based on how well and quickly the corporation and its employees respond to the adoption of new applications, different business processes, new hardware and different development methodologies. In a similar manner, universities are being challenged to react with a new paradigm generated by the rapidly emerging technologies. Investigating corporate strategies may provide some guidance to those teaching in a university environment.

Success depends upon how well corporations provide their employees with the resources necessary to effectively use these technologies, thereby enabling them to deliver new products or services to the clients. This is in many ways a paradigm shift because it requires a change in cognitive process concerning the approach to a certain business process or a design of applications while in the process of adopting new learning processes. It can be assumed that the employees are also contributing to the knowledge base repository in the corporations, which is fundamental to the technology driven industry. Additionally, there has to be a seamless alignment among the pre-existing corporate environment since any misalignment may not only cause tremendous burden on the corporation and its clients, but economically it may be disastrous. To overcome these issues the corporations are aggressively adopting industry wide in-house educational and knowledge enhancement programs. While these programs may not be in direct competition with a university curriculum, the university is often pressured to teach similar skills. Examining the issues faced by corporations may help universities address these demands, especially to differentiate between education and training. These corporate programs may also have some shortcomings.

Knowledge management and e-learning methodologies are driving change in the instructional environment. Because they both require the same infrastructure, these two new methods of acquiring knowledge can be further broken down into self-paced or on-line interactive learning. These two methods create a knowledge base, which creates a learning platform, which provides the need-based instruction to individuals.

The questions that this paper addresses are:

- Are these new methods actually benefitting the technology driven economies and are the user/consultants/developers accepting this paradigm?
- Can universities apply some of these new learning environments to either improve current curricula or create new ones?

This research studies a set of corporations and the processes they have adopted in their corporate wide employee knowledge enhancement programs. Sometimes the new process works and sometimes it does not; this study identifies both. This study also examines the cost benefit of e-learning and e-training. It also looks into an employee's comfort level with different instructional environments. It is anticipated that other issues will be discovered in this research that will benefit both corporations and universities.

BE PREPARED FOR THE WORKING ENVIRONMENT—TEAMWORK FOR INFORMATION SYSTEMS STUDENTS

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ABSTRACT

Collaborative learning could be defined as a situation in which two or more people learn or attempt to learn together. In such a situation, students could benefit from working together, but there are also a lot of difficulties to overcome in this environment. The Department of Informatics at the University of Pretoria challenge their third year students with a major project where they have to develop an Information system for a real client. While working on the project, the students are implicitly exposed to communication and interpersonal skills, as defined in the IS'97 curriculum. Communication skills include listening skills, negotiation skills, interviewing skills, facilitation skills, observation skills and presentation skills. The skills of leadership, small group communication skills, small group organization and working with diverse people are listed among the interpersonal skills. In the groups the students are confronted with a lot of problematic situations, such as conflict between the members, and dominant group members. The article discuss these problems under the following headings: One group member does all the work; Dominant group members; Self-oriented need of group members; Logistical problems; Inability of a group to come to a decision; Cultural diversity and Groups being more socialistic than productive. The advantages of collaborative learning are evaluated based on a classical case study, Twelve Angry Men, where four important factors regarding teamwork, and team dynamics are discussed. These factors are briefly discussed as Leaders Engage Inquiry; Vigorous Pursuits of Decisions; Conflict Serves the Group Process and the Benefit of Varying Backgrounds. All of this is then applied and evaluated based on the actual projects of the third year students, and the practical findings are discussed in detail under above-mentioned headings. Finally, a brief preview is given on future work regarding the teams and the projects in the final year of study for the Information Systems students.

INTRODUCTION

With the rapid changing environment and the continuous pressure on the Information Systems environment in South Africa, as well as in the rest of the world, the challenge lies in the hands of the lecturers of Information systems students to make sure that they are trained and equipped for the real world. The University of Pretoria is currently focusing all of their education to be internationally competitive, but locally relevant. When looking at the IT environment, this means that the students must be equipped with both the theory of Information systems and the skills of analysis, modeling and programming. All of this could be taught in a classroom situation, and practical sessions, but some of the skills required by the IS'97 curriculum for IS personnel in the modern world, are not addressed in a classroom situation. As mentioned by, Thomas (2000) in her Doctoral theses on group work, most of these skills are implicitly enforced on the students by placing them into groups. In the Department of Informatics the students are challenged with a major group project in their final year. The focus of this paper is to look into the group work of these students.

This paper is set up as follows. The teamwork and collaborative learning section will discuss some theoretical issues concerning teamwork and collaborative learning. The projects in the third year section will describe the third year project by looking at the group work situation. Before the conclusion, the expectations and future work section will briefly list our expectations and future work with these projects.

TEAMWORK AND COLLABORATIVE LEARNING

According to Pierre Dillenbourg's book, *Collaborative Learning—Cognitive and Computational Approaches*, collaborative learning could be defined as a situation in which two or more people learn or attempt to learn together [Dillenbourg, 1999]. In trying to attempt this goal of learning something, there are several factors that work into a group or a team of people. In a classical case study, Twelve Angry Men [Twelve Angry Men, CASE STUDY], four important factors regarding teamwork, and team dynamics are discussed. These factors could be of great value to the student in the learning environment if they are applied correctly. These factors would now briefly be discussed.

Leaders Engage Inquiry

Effective team leaders encourage everyone to participate on an equal basis. The leader does not impose his or her views, but uses open inquiry to weigh the facts and clarify ambiguities. It takes courage for a leader to operate on equal terms with other people and to resist taking over the discussion or pulling rank.

Vigorous Pursuits of Decisions

A work group entrusted with a decision cannot allow itself to avoid its responsibility, but must stay together and work through its differences. As discussions heat up and become complicated, teams often look for a way out. They try to find a "quick fix of limit their discussion to a part of the problem in order to escape from a messy situation. Although teams are usually not locked up in conference rooms like a jury, they need to understand that they're accountable for making a good decision.

Conflict Serves the Group Process

When team members have a common goal and feel accountable to each other, conflict can be safely used to understand varying points of view. When there is trust among team members, conflict can generate new ideas and breakthroughs. Conflict highlights different points of view and the way each person sees things. Without trust, however, conflict becomes destructive and damages the team.

Benefit of Varying Backgrounds

Quality decisions depend on tapping the diversity of experience present in the group. The term "diversity is often limited to differences of color, nationality or gender, but the true value of diversity is the wealth of experience and perceptions brought by each individual to the team. Teams learn that different people because of their unique life experiences see information or 'facts' differently. Decisions are most effective when a diversity of viewpoints is available to the team.

When looking at the IS profession, there are a great emphasis on teamwork and group working skills. These skills are also recognized by the curricula for IS students. The IS'97 Curriculum [Davis et al., 1997] recognizes this need for the softer skills and has communication skills and interpersonal skills as two of the main characteristics needed by an IS graduate. This is shown in Table 1. Communication skills include listening skills, negotiation skills, interviewing skills, facilitation skills, observation skills and presentation skills. The skills of leadership, small group communication skills, small group organization and working with diverse people are listed among the interpersonal skills.

Personal and interpersonal skills are also deemed important in the Informatics Curriculum Framework 2000 (ICF-2000) for Higher Education [Mulder & van Weert, 2000]. In this, they've identified three categories of Information systems professionals, namely information users, information appliers and information workers. Out of this, the ICF-2000 even suggests that communication skills, and interpersonal skills should not only be part of the curriculum, but should be credit bearing.

TABLE 1
CAPABILITIES AND KNOWLEDGE EXPECTED FOR IS PROGRAM PROFESSIONALS
[Davis et al., 1997]

Characteristics	With the ability to...	Using the knowledge of...
Communication	• accurately observe, note and explain observations of events; • actively listen and express complex ideas in simple terminology; • organize and make presentations; • write memos, reports and documentation.	• listening, observing and documenting; • interviewing and speaking; • negotiation and facilitation; • presentation and interpretation of data; • multimedia development and utilization; • computer and video conferencing techniques.
Interpersonal Relationships	• effective work with people of diverse backgrounds; • effectively work with people at all corporate levels; • lead and facilitate teams in a collaborative environment; • develop win-win approaches; • empathetically listen and seek synergistic solutions.	• leadership, management and organizations; • small group communication and motivation; • organization, team and individual goal setting; • share vision and responsibility; • cultural diversity.

To conclude this discussion on teamwork and collaborative learning, we would briefly look into some problems expected with group work. Research has shown that there are many advantages to working in groups, but there are also several problems. Some of these problems will now be discussed.

One group member does all the work. Some people are perceived to do most of the work while other students depend on the good students in the group. The less able team member leaves it to the others to do all the work, and thus creating a "free riding effect. The more able team member, who is doing all the work, feels like a "sucker . This situation is also referred to as "social loafing [Abrami et al., 1995]. One of the suggested solutions to this problem is that the participant must change from listener, observer and note taker to active problem solver, contributor and discussant [Daigle, 1996].

Dominant group members. Some students are merely shy and do not participate for this reason. Some students feel that being put in the public eye is a position of risk [Thomas, 2000]. Others might dominate the group, even if the others would like to contribute, those students take over. The dominant student is often egoistic and refuses to consider the perspectives of others in the group.

Self-oriented need of group members. Some students have self-oriented needs and this can interfere with the work of the group as a whole. For instance, students with high-level abilities complain about being held back by slower team members. Students then often decide to divide the work; one might be the thinker, while the other is the typist. Another situation might be when one group member does all the work for one assignment, or deliverable, while the other student do all the work for the next [Thomas, 2000].

Logistical problems. There can be problems if students are expected to do group work outside of class time. A great deal of time can be spent trying to get everyone together for meetings, especially if some students are not motivated.

Other problems such as **inability of a group to come to a decision, cultural diversity** problems based on knowledge and trust, **groups being more socialistic than productive** are also discussed in a thesis by T.A. Thomas, "A Teaching Environment for Learning Soft Skills Applicable to Information Systems Development [Thomas, 2000].

The next section will explain the group assignments and project the third year students have to complete as part of their final year of undergraduate studies in Information systems at the University of Pretoria.

PROJECTS IN THE THIRD YEAR

The purpose of this course is to give students the opportunity to be part of an information development project that is as near to real-life as is possible. They are expected to analyze, design, test and implement an information system, for a real user with a real information system need, as part of a project team. The course aims to establish and integrate the theoretical and practical work done in the first two years of study and to prepare students better for the working life.

Students must work in a project team, consisting of three or four members as chosen by themselves. The teamwork teaches students to work together in groups on a very important project (their degrees depend on it) and to learn how to handle the inevitable conflict that arises out of it. The teams operate without a project leader and have to resolve leadership roles among themselves.

Although specific work is allocated to individual team members, all team members must understand all aspects of the system at all stages of the development. This includes both functional and technical issues. This is tested during every deliverable of the system. For instance, although one team member will probably research how to setup and use the bar code reader, all team members must be able to do it as well.

The benefits of the project can only be achieved if the project is big enough and complex enough. See Appendix A for a description of the quantity and size of the project.

A fairly standard System Development Life Cycle (SDLC) is followed and students have the choice of using traditional (data-flow diagrams, ERDs) or object-oriented techniques (UML). They have to produce the following deliverables and demonstrations.

TABLE 2
THE PROJECT DELIVERABLES

Deliverable	**Weight**
Deliverable 1 Project proposal	1.0
Deliverable 2 Analysis, feasibility study and detailed requirements	2.0
Deliverable 3 Functional specification	2.0
Deliverable 4 Technical design and test specifications	2.0
Deliverable 5 Maintenance document, user manual and training material	1.0
Demonstration 1: Technical features demonstration	2.0
Demonstration 2: Working prototype	1.0
Demonstration 3: Final demonstration and project day	3.0
TOTAL	14.0

Deliverables are marked during a meeting with the course coordinator of between 30 minutes and one hour depending on the type of deliverable. Certain demonstrations are also given where students are expected to do a formal presentation. Some of these demonstrations constitute the examinations and are marked by between two and three lecturers, depending on the type of demonstration. These sessions teach students how to present completed work to their users, management and other interested parties.

Other courses in the third year are supplementary to the project work done. An advanced Delphi and network course is given in the first term to prepare students. In the second term (when conflict and tension is normally at its highest) a course is given that considers, among other things, teamwork and project management.

Practical Findings

- Students mostly exceeded our expectations. They work harder than anticipated and the course coordinator in many cases had to advice them to work less. One of the big problems is ensuring that students don't neglect their other subjects. At certain points during the project students can work up to 60 hours per week each.

- Most of the team problems and advantages discussed in Section 2 were experienced by the teams. The most common problems were:

  - **One group member does all the work**. Although students choose their own teams, quite a few of the teams build up a lot of interpersonal tension. The biggest source of tension is one or more members not doing their part. In most cases these issues can be resolved in conjunction with the course coordinator. In severe cases were communication have broken down completely, team members communicate formally by letter with the course coordinator as middleman.

  - **Self-oriented need of group members.** Another source of tension in the groups are the different levels of commitment by each team member. Some team member's commitment is towards a winning project, while other team members barely want to complete the project in order to obtain the credits for the course.

  - **Conflict serves the group process**. In most cases, conflict in the group is because of different perspectives on the solution. This conflict often leads to a better solution of the problem at hand. Only in very extreme cases, the conflict leads to total breakdown of the groups, or even the inability to complete the project.

  - **Logistical problems**. For the bigger teams, logistical problems are often their downfall. Much of their time often go into a process of finding a time that will suit everyone, and even when finding a suitable time, it could be at an impossible time of the day and night, or even with a lot of interruptions. This also disables the groups to put in long productive sessions for effective group work.

EXPECTATIONS AND FUTURE WORK

- The ultimate goal to work for is to prepare the students for the real world as good as possible. This can only be done by enhancing the pressure and diversity of the group, and to focus more on the interpersonal and communicational skills of the students.

- Out of the experiences from some of the groups, especially the groups that failed to succeed, some extremely valuable lessons were learned. Since the main reasons for failure were either inter-team problems, or the inability for estimating the size of the project, and thus starting too late, project managers will be appointed in the future. The role of this project manager would be to, firstly, resolve problem issues inside the groups, and secondly to plan the project throughout the SDLC.

- Most of the students choose their teams themselves; therefore the groups are extremely homogeneous, in terms of language, culture and even backgrounds. As mentioned in Section 2, diversity can benefit the group work and contribute to a better understanding of the problem and even a better solution to the problem. Therefore, combining diverse people into one group can be considered in the future.

CONCLUSION

Supplementing formal learning with collaborative group learning ensures a number of benefits.

Students learn some of the important aspects that can't really be taught in a formal class situation. Most students still have a very mechanistic view of developing systems. In this view problems are straightforward and can be resolved if you just use the right technique. Even after formal lectures on the softer issues involved with systems development students still have a very naïve view of what systems development is all about. When put into teams, they find, by first hand experience, that the softer issues are extremely important. If your user is too busy to give you specifications or to test the system and your deadline approaches, what do you do? If team members disagree and can't get any work completed, knowing about the SDLC does not help a bit.

Students also learn not be afraid of conflict and how to resolve conflict themselves. Only in severe cases will the lecturers help to resolve conflict. Lecturers must view conflict as a mechanism for learning and not something to avoid.

Very importantly, students learn who they are. In most cases students can do much more than they ever dreamt possible. Just as importantly they learn their own limitations and idiosyncrasies.

We can only expose information systems students to the "real world by letting them experience it to a certain extent. One of the best ways is through collaborative teamwork in the safety of the learning environment.

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APPENDIX A

The size of the system must be between 1,000 and 1,400 size units. Size units are allocated as follows.

Development Object to Be Counted	Size Units per Object	Minimum Units per System
Simple reports	1	14
Complex reports (3 levels of control breaks with totals)	3	7
Simple logical screens (one function, for instance, adding, deleting, updating or viewing a client)	1	200
Complex screens (Interlinking multiple functions, for instance, displaying master detail)	3	50
Tables in the database	2	60
Table relationships (One-to-many, etc.)	1	40
Interfaces to external devices	5	1
Online document (help, user manual, etc.) parts. (Count every non-repeating index and link)	1	300
Non-database files	2	4
OLE interfaces to MS-Word, etc.	10	2

The system must have at least the following functionality over and above the client's requirements.

- The systems cannot only be of a technical nature (e.g., a weather modeling system). At least 80% of the system must be of a business nature. (E.g., stock management, banking, retail, creditors, debtors, MRP, manufacturing (non-technical side), etc.).
- Proper security, including encryption of passwords, user profiles, etc.
- A complete context-sensitive Web-based help file.
- A complete suite of reports.
- OLE interfacing to any Windows program directly from the program. E.g., creating a letter to the client in MS-Word from information in the database.
- The use of grids, for multiple rows of data, where appropriate.
- The use of master-detail table relationships.
- Maximum flexibility. E.g., a list of branches should not be hard coded but maintained in a sub-module of the system.
- The use of graphs, where appropriate.
- A totally self-contained installation disk and instructions for the system. This installation must also create the ODBC settings needed and an entry in the Windows Start/Program menu. An uninstall feature must be provided that will completely delete all traces of the installed system.
- The storage and display of graphical information, like photos.
- A link to an accounting package, like Pastel, for the automatic creation of General Ledger batches.
- A Web-server interface to the system where users can capture and display specific database data.
- Automatic creation of e-mail messages.
- The system can't only be a database maintenance system, the major part of the system must be transaction processing; e.g., ordering stock, creating invoices, etc.
- An audit trail of all transactions in the system.
- At least one direct interface to an external device (not a printer or a screen). This could be a digital camera, swipe card reader, bar code reader, scanner, voice recognition device, etc.
- User-friendly error messages. System error messages must be intercepted and made user-friendly.
- Basic interfacing to the Windows system registry.
- Full access to one or more files in the system (Create, update, read, delete).

- At least one function in the system must be timer related. For instance, every hour while the system is running, determine the stock levels of the system and prompt the user to take appropriate action if the stock levels are too low.

- Referential integrity must be enforced. If a user tries to delete a parent record with dependent children records, stop deletion or warn and cascade the deletion.

- A complete easy-to-use backup and restore sub-system.

- The proper use of standard key strokes, e.g., Ctrl C Copy, Ctrl X Cut, etc.

The system must be broken up into 3 or 4 (depending on the number of team members) distinct functional parts of approximately the same size. Every team member must develop one of these parts for the final project demonstration and will be evaluated individually.

The system cannot be developed in database software (e.g., ACCESS reports and forms). A programming language such as Delphi or Visual Basic must be used to interface to such databases.

MOBILE TECHNOLOGY AND ONLINE CLASS DISCUSSIONS: A CONCEPTUALIZATION IN M-LEARNING

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Extended Abstract

Sahai and Machiraju (2001) describe the development of Totale-Mobile, Hewlett-Packard's (HP's) infrastructure for delivering e-services to the heterogeneous mobile computing/communications community using a "One URL fits all"® approach that "scales" a single web page to the requesting device, be it a pager, phone, PDA or PC. This convergence enables a host of previously inconceivable or infeasible opportunities both for Mobile Commerce (m-Commerce) and Mobile Learning, or m-Learning, applications. One such application in the m-Learning realm is the mobile online class discussion conceptualized herein.

Recently, threaded discussion has been widely adopted by the academic community as a collaborative learning technique and, despite its inherent limitations, its value as such has been well-established. In the 1980's, the Unix-based Usenet and dial up bulletin boards defined the first generation of threaded discussion and the geo-dispersed community phenomenon was established. Then, in the 90's, the availability of Web-based, hosted (typically free) discussion group services brought a new level of accessibility and usability for both students and instructors, clearing the way for this second generation incarnation to become a mainstay of the emerging learner-centric educational pedagogy.

The benefits are clear and tangible, yet limited still, in this second generation, by 1) the fact that, for the most part, discussion groups are accessible only via personal computers (PC's) and 2) the passive nature of the medium—the burden lies with the discussion participants to monitor the discussion site to check for new activity. When discussion activity is low, frequent checks of the site will disappoint participants, dampen their enthusiasm and lead to less frequent checking which in turn lowers activity further, feeding a vicious cycle toward extended periods of dormancy. Some discussion services provide a partial remedy by alerting authors, via email, that a reply has been posted, but this only improves things incrementally and only if participants check email more frequently than the discussion site. Without email pagers like the RIM Blackberry, participants are still bound by any physical location constraints that hamper their connectivity.

Emerging mobile technologies provide a vehicle for evolving threaded discussion to a third generation that better emulates face-to-face discussions by *delivering the discourse, in device-scaled form, to the participants in real time wherever they are.* Thus, the 3G threaded discussion is liberated from the desktop and the qualities of dynamism and immediacy found in "instant messenger" services are extended to the geo-dispersed discussion, taking the paradigm from "pull," beyond "push," to a "reach" orientation. In its mobile-enabled 3G form, threaded discussion will afford a greater sense of synchronicity and dynamism as participants are apprised of activity as it occurs and, depending on their individual device, may be able to respond immediately. And 3G threaded discussion interaction will be tailored to the capabilities and preferences of individual participants though customizable agents to optimize effectiveness and to prevent intrusiveness and the annoyance associated with information overload. Clearly, providing this kind of highly customizable service across the diverse array of connective devices found among a typical university-level class is a valuable m-Learning enhancement being enabled by emerging mobile technologies such as those developed at HP.

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ACCOMMODATING ACCOUNTING MAJORS IN A REQUIRED CIS BEGINNING PROGRAMMING COURSE: APPROACH AND RESULTS

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Extended Abstract

Critical-thinking skills in general, and computer-comprehension skills in particular, are increasingly seen as necessary for the successful accountant as well as for the information-systems professional. While other universities have developed separate accounting information systems programs, we have addressed this critical thinking issue by incorporating three existing computer information systems (CIS) courses into our accounting major, including a beginning programming course, an analysis and design course, and a database course. We encourage our accounting students also to obtain a CIS minor, which requires an additional 12 credit hours, or even a second CIS major while working toward their 150 credit hours and passage of the CPA.

The inclusion of a required beginning-programming course in the accounting major is somewhat controversial as it is thought too demanding by some aspiring accounting students and they often begin the course wondering what programming has to do with accountancy. Considerable work has been conducted to adapt our beginning programming course to applicable to both CIS and Accounting students and we spend significant time in the course helping accounting students understand that this course will aid them in several aspects: First, it will improve their understanding of how a computer works and what it can do and cannot do. Second, it will improve students' critical and creative thinking skills, and third, it will improve their ability to develop and comprehend accounting "algorithms", allowing them, for example, to locate a "bug" or "embezzle hole" in an accounting flowchart.

Ours is a rigorous beginning programming course similar to what is taught in a computer science department; generally roughly half of the students who start the course receive a grade of "C" or higher. It includes subroutines and functions with pass-by-value and pass-by-reference parameter passing, sequential file access, array-searching algorithms, and an extension of the bubble sort to solve a payroll problem. While many of the problems focus on business applications, we have found that fun graphic projects, such as building "choo choo train" screen saver, provide increased student motivation while still teaching the essential course concepts. Considerable time is spent teaching a structured approach to problem solving including learning to design carefully algorithms using pseudo code and structure charts. Functional cohesiveness with procedures and modularization are emphasized.

Accounting students have done quite well in this 200 level course. We examined the grades of all declared accounting and CIS students who took this course during the 1999 and 2000 school years (35 CIS majors and 31 accounting majors). On a A = 4 and F = 0 scale, declared accounting students and declared CIS majors each had an average grade of 2.51. And 68% of declared accounting majors had a grade of "C" or better while 67% of declared CIS majors had a grade of "C" or better. Other preliminary results indicate that accounting students, who have successfully completed the beginning-programming course, perform better in our 300-level advanced accounting course than those who have not.

Further, the influx of roughly 50% accounting students into the beginning-programming course has had the additional positive effect of increased mutual respect between accounting and computer information system students. The accounting students have come to realize that programming is a demanding intellectual activity as intense as anything in the accounting program. And CIS majors have come to realize that the accounting majors can match them at their own game.

Acceptance of accounting majors in the beginning-programming course is on the rise, many accounting majors are completing the CIS minor, and a significant number are adding a second CIS Major. While our approach of adding existing CIS courses to the accounting major appears to be a viable alternative to a separate AIS curriculum, it success is highly depending on several factors: first, on having fairly small class sizes; second, on having the support of the college and university administration; and third, on having the cooperation of the CIS faculty teaching these courses, as they must spend additional time developing and teaching these courses when they include accounting and other non-traditional programming students.

IS 2002: AN UPDATE OF THE INFORMATION SYSTEMS MODEL CURRICULUM

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INTRODUCTION

IS 2002: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems is the latest report on the model curriculum work in the information systems field. The work of IS curricula task groups began in the early 1970s and has continued for the past 30 years. The Association for Computing Machinery (ACM) has been a major organizer for these task groups including the first efforts in the 1970s. Other organizations, including AIS (Association for Information Systems), AITP (formerly DPMA) and IFIP (International Federation for Information Processing), have aided model curriculum development.

IS 2002 is the second collaborative effort between ACM, AITP, and AIS. All three organizations have worldwide membership. ACM has both professional and academic members in the broad field of computing. Through its Education Board, it supports a wide range of curriculum development including computer science, information systems, and software engineering. AITP is a professional organization primarily composed of information system practitioners that focuses on education and professional development of its members. AIS, organized in 1994, is composed of faculty members in information systems. The partnership of ACM, AITP, and AIS, therefore, combines the breadth of interest of ACM, AITP, and the information system interests of AIS.

Although ACM, AITP, and AIS are worldwide organizations, IS 2002 does not represent a universal curriculum. It does not seek to harmonize the curriculum to meet the requirements of different educational systems around the world. The model curriculum for undergraduate degree programs in information systems is based on the typical degree structure in USA and Canadian universities. The model curriculum can, however, serve as a useful reference for designers of information systems degree programs outside the USA and Canada.

The most recent undergraduate curriculum model, IS '97 (Davis et al., 1997; Couger et al., 1997) was circulated in draft form in 1994 (Gorgone et al., 1994; Longenecker et al., 1994) and 1995 (Couger et al., 1995) and finalized in 1996. Members of the Joint Task Force presented drafts of IS '97 at numerous conferences from 1994 to 1996 and received significant feedback that substantially strengthened the report. Additionally, much of the work for the 1997 model was actually completed between 1994 and 1995. Thus, it has been approximately seven years since the current model curriculum has been updated. Since 1997, the task force members have been collecting survey data to better understand who and how the model curriculum was being used. Given the changes that have occurred since 1995 in the information systems discipline, this paper provides a preliminary report on the process of updating IS '97.

In the next section, we briefly outline the motivation behind the need to update IS '97. This is followed by a brief review of the guiding assumptions about the IS profession that helped to shape the curriculum design and evolution. Next, the scope of the curriculum update is presented so that programs transitioning from IS '97 to IS 2002 will better understand the model's evolution. This is followed by a brief presentation of the course architecture and intended course sequence. Finally, the paper concludes by providing high-level course descriptions of the IS 2002 model curriculum.

MOTIVATION FOR CURRICULUM UPDATE

Since the last revision of the undergraduate curriculum guidelines, three major factors have spurred the need to reexamine and update the existing standard. In particular, the advent of the Internet, the changes in student computing literacy, and the information accreditation movement all motivate the need to update the curriculum. In this section, we briefly review each of these motivating factors.

Internet Revolution

As discussed previously, much of the work in developing IS '97 occurred prior to 1995. During the writing of IS '97 the utility of Web and Internet programming was not yet foreseen, with limited references to thin-client programming concepts, Internet protocols and internetworking, and other relevant content. Although it was known that the impact of these then novel concepts could be enormous, it was at the time unrealized. In the intervening years the Internet has grown to become a major aspect of all IS environments.

Changes in Student Computing Literacy

Over the past decade, there has been a significant change in the basic computer literacy of incoming university students. In the past, very few students entered a university having significant skills in using a desktop computer, with even fewer students owning or having easy access to a computer. Today, with the advent of the Internet revolution and low cost PC's, most students entering a university today have at least a modest level of computer literacy.

Information System Accreditation Movement

There has been interest in the accreditation of programs in Information Systems since the accreditation of programs in computer science was begun in the mid 1980s. The work on IS '97 with its support from the major IS professional societies provided much needed catalyst for IS accreditation to move forward. With the support of the National Science Foundation, the Criteria for the Accreditation of Programs in Information Systems have been developed with IS '97 serving as the basis of the IS curriculum criteria. ABET is the agency with responsibility for accrediting all programs in computing, engineering and technology (Gorgone & Lidtke, 2000). The Computing Accreditation Commission (CAC) has responsibility for accrediting computer science and information systems programs. The first pilot visit was completed during Fall 2001.

GUIDING ASSUMPTIONS ABOUT THE IS PROFESSION

In conceptualizing the role of information systems in the future and the requirements for IS curricula, it seems apparent that several elements have been (ACM '72, ACM '82, IS '90, IS '97, and ISCC '99) and remain important and characteristic of the discipline. These characteristics evolve around three major areas that permeate all aspects of the IS profession and therefore must be carefully integrated into any IS curriculum:

1. IS professionals must have a broad business and real world perspective. Students must therefore understand that:

   - IS enables the success of organizations

- IS span and integrate all organizational levels and business functions

- IS are increasingly of strategic significance because of the scope of organization systems involved and the role systems play in enabling organizational strategy

2. IS professionals must have strong analytical and critical thinking skills. Students must therefore:

    - Be problem solvers and critical thinkers

    - Use systems concepts for understanding and framing problems

    - Understand that a system consists of people, procedures, hardware, software and data

    - Be fluent with enterprise data acquisition, conversion, transmission, measurement, organization, storage, and applicability for individuals at all organizational levels

    - Be capable in applying both traditional and newly learned concepts and skills

    - Possess skills in understanding and modeling organizational process and data, defining and implementing technical solutions, managing projects, and integrating systems

    - Focus on the application of information technology in helping people achieve their goals. Organizational productivity is the desired result; people are the focus.

3. IS professionals must have strong interpersonal communication and team skills. Students must understand that:

    - IS requires collaboration as well as successful individual effort

    - IS design and management demands excellent communication (oral, written, and listening)

    - IS requires curiosity, creativity, risk taking and a tolerance of these abilities in others

SCOPE OF CURRICULUM UPDATE

Recently a survey of computing faculty in the United States has been conducted to ascertain information on two areas. The first was to determine their current view of the appropriate depth of mastery for each of the elements in the IS '97 body of knowledge. The second was to gather similar information for key skill areas identified within IS '97. Some of the observation of this research has been published (Longenecker et al., 2000; Landry et al., 2000). The primary conclusions are summarized as:

1. IS analysts have specific skills at approximately IS '97 skill depth level 3 (the ability to *USE* knowledge) in areas of Interpersonal and Team Skills, Business Knowledge, Organizational Process Development (including IS Systems Analysis and Design), Project Management, Database, Software Development, Web Programming, and Systems Integration.

2. Skills identified in IS '97 as Exit Curriculum Areas match expectations of the computing industry as well as IS faculty.

3. Skill areas produced by programs of Information Technology match expectation of Information Systems faculty.

4. The model courses of IS'97 are acceptable to both IS and IT faculty. Interestingly, both CS and SE faculty also feel IS'97 courses are relevant.

When analyzing survey data and IS'97 curricula in summer of 2001, the missing element in the curriculum was a course focusing on Internet-based commerce. At most universities, this course has been a popular required course for several years and so there was a clear discrepancy in the existing model curriculum and what was being operationalized in most universities. Thus, a new course was added to the model curriculum, IS 2002.2–*Electronic Business Strategy, Architecture and Design*, to address this limitation. Without restructuring other aspects of the model curriculum, the addition of a new Internet-based commerce course to the model curriculum would result in curriculum of eleven required courses. There was a desire by the committee to limit model curriculum to a target of ten courses, or 30 semester units, which therefore would result in the elimination of one of the existing IS'97 courses. This decision was driven by recently approved accreditation standards and by the practical credit hour constraints realized by many IS programs.

IS '97 had a prerequisite course, IS '97.P0–*Knowledge Work Software Tool Kit*, that assumed students had elementary exposure to a suite of software tools useful for knowledge workers (spreadsheets, databases, presentation graphics, database retrieval, statistics, word processing, and electronic mail). It was also assumed that students could gain this knowledge through a formal course or through self-study modules. Beyond this course, IS '97 had a required course, IS '97.2–*Personal Productivity with IS Technology*, that focused on improving student skills in using packaged software, in both individual and group work, by designing and developing solutions. Given the need to limit the IS 2002 curriculum to ten courses and the rapid and significant improvement in the general computing literacy of entering students, IS '97.P0 and IS '97.2 were melded into a single prerequisite course, IS 2002.P0–*Personal Productivity with IS Technology*.

Beyond the addition of the Internet-based commerce course, IS 2002.2, and the melding of IS '97.P0 and IS '97.2 into a single prerequisite course (or self-study modules, see below for more details), the remaining courses were retained with appropriate updating of the course "Scope" and "Topic" descriptions. In most cases, this resulted in the addition of Internet centric-content and more contemporary terminology and concepts. For all but one, course names remained unchanged. However, IS '97.9–*Physical Design and Implementation with a Programming Environment* was changed to IS 2002.9–*Physical Design and Implementation in Emerging Environments*. This change was motivated by the continual evolution in rapid application development and programming environments. A mapping courses and a summary of the changes is represented in Table 1.

COURSE ARCHITECTURE AND SEQUENCE

The IS 2002 curriculum assumes that students have a prerequisite knowledge of desktop computing. Specifically, it is assumed that students have an elementary exposure to a suite of software applications useful for knowledge workers such as word processing, spreadsheets, Email, and Internet browsing. In addition, students are assumed to also have knowledge and skill of IS technology to be a successful knowledge worker as described in the prerequisite course IS 2002.PO–*Personal Productivity with IS Technology*.

Figure 1 shows the course architecture and sequence of courses within IS 2002, including the prerequisite course IS 2002.P0. The structure is a "suggested" architecture and sequence with the appreciation that each university's situation is somewhat unique. In any event, this architecture allows the entire program to be completed within a scope of two years. This model will therefore fit within the broader curricula constraints of must business schools. For IS programs housed outside business, great flexibility in the sequence can be employed.

COURSE DESCRIPTIONS

In this section, we conclude by providing high-level course descriptions for IS 2002 which includes the prerequisite Personal Productivity with IS Technology (IS'02.P0) course plus the ten courses within the Model Curriculum. A title, statement of scope, and list of typical topics are used to describe each course.

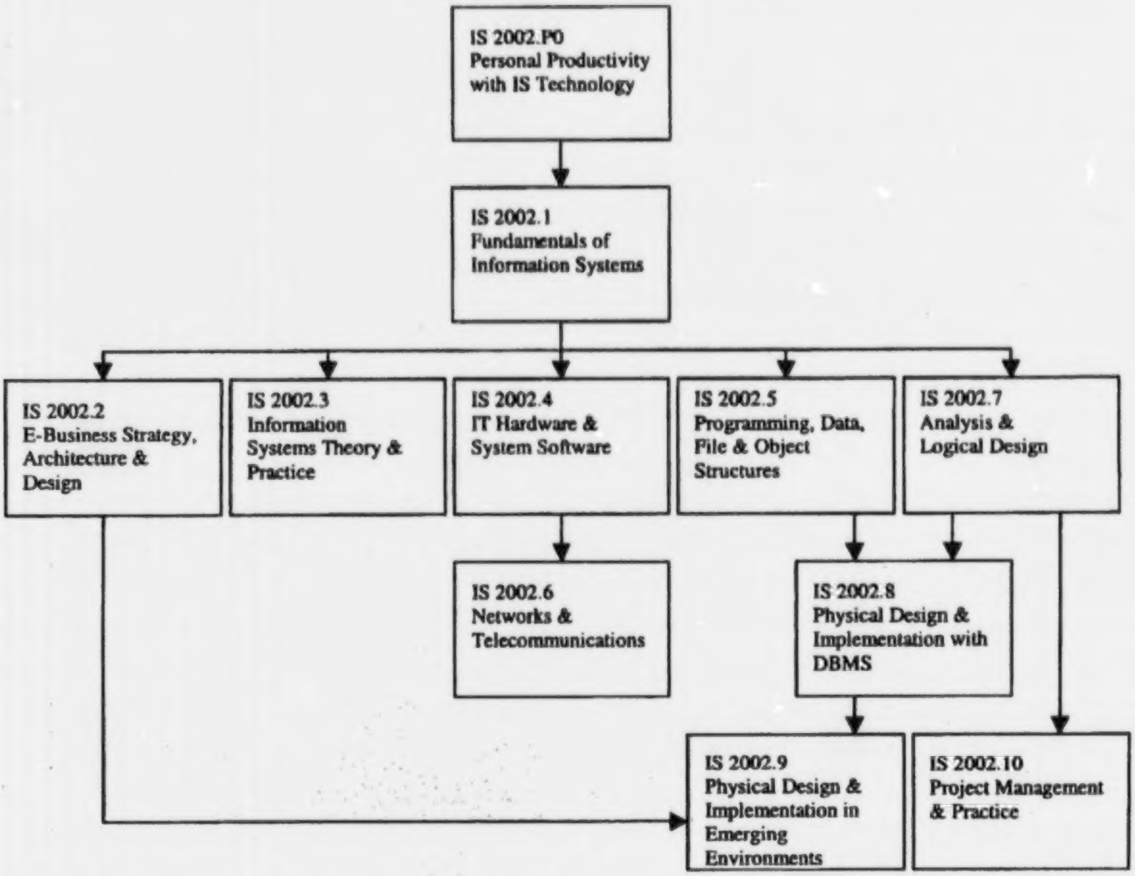
IS 2002.P0–Personal Productivity with IS Technology
(Prerequisite: elementary knowledge of word processing, spreadsheets, Email, and Internet browsing)

SCOPE	This prerequisite course enables students to improve their skills as knowledge workers. The emphasis is on personal productivity concepts through using functions and features in computer software such as databases, presentation graphics, and Web authoring. Although identified as a course, this material can be delivered as self-study modules, as modules associated with other courses using the software, or as a full course.
TOPICS	Knowledge work productivity concepts; advanced software functionality to support personal and group productivity such as templates and macros; reuse rather than build from scratch; organization and management of data (sorting, filtering) via spreadsheets and database tools; accessing organization and external data; information search strategies; tool use optimization and personalization; professional document design; Web page design and publishing; effective presentation design and delivery.

TABLE 1
MAPPING OF IS 2002 COURSES TO IS '97 COURSES

IS 2002 Courses		IS'97 Courses
IS 2002.P0 – Personal Productivity with IS Technology	← MELDING ←	IS'97.P0 – Knowledge Work Software Tool Kit IS'97.2 – Personal Productivity with IS Technology
IS 2002.1 – Fundamentals of Information Systems	UPDATE ←	IS'97.1 – Fundamentals of Information Systems
IS 2002.2 – Electronic Business Strategy, Architecture and Design		NO EXISTING COURSE
IS 2002.3 – Information Systems Theory and Practice	UPDATE ←	IS'97.3 – Information Systems Theory and Practice
IS 2002.4 – Information Technology Hardware and Systems Software	UPDATE ←	IS'97.4 – Information Technology Hardware and Systems Software
IS 2002.5 – Programming, Data, File and Object Structures	UPDATE ←	IS'97.5 – Programming, Data, File and Object Structures
IS 2002.6 – Networks and Telecommunication	UPDATE ←	IS'97.6 – Networks and Telecommunication
IS 2002.7 – Analysis and Logical Design	UPDATE ←	IS'97.7 – Analysis and Logical Design
IS 2002.8 – Physical Design and Implementation with DBMS	UPDATE ←	IS'97.8 – Physical Design and Implementation with DBMS
IS 2002.9 – Physical Design and Implementation in Emerging Environments	UPDATE ←	IS'97.9 – Physical Design and Implementation with a Programming Environment
IS 2002.10 – Project Management and Practice	UPDATE ←	IS'97.10 – Project Management and Practice

FIGURE 1
IS 2002 COURSE ARCHITECTURE


IS 2002.P0
Personal Productivity with IS Technology
IS 2002.1
Fundamentals of Information Systems
IS 2002.2
E-Business Strategy, Architecture & Design
IS 2002.3
Information Systems Theory & Practice
IS 2002.4
IT Hardware & System Software
IS 2002.5
Programming, Data, File & Object Structures
IS 2002.7
Analysis & Logical Design
IS 2002.6
Networks & Telecommunications
IS 2002.8
Physical Design & Implementation with DBMS
IS 2002.9
Physical Design & Implementation in Emerging Environments
IS 2002.10
Project Management & Practice

IS 2002.1–Fundamentals of Information Systems (Prerequisite: IS'02.P0)

SCOPE This course provides an introduction to systems and development concepts, information technology, and application software. It explains how information is used in organizations and how IT enables improvement in quality, timeliness, and competitive advantage.

TOPICS Systems concepts; system components and relationships; cost/value and quality of information; competitive advantage and information; specification, design and re-engineering of information systems; application versus system software; package software solutions; procedural versus non-procedural programming languages; object oriented design; database features, functions, and architecture; networks and telecommunication systems and applications; characteristics of IS professionals and IS career paths. Practical exercises may include developing macros, designing and implementing user interfaces and reports; developing a solution using database software.

IS 2002.2–Electronic Business Strategy, Architecture and Design (Prerequisite: IS'02.1)

SCOPE This course examines the linkage of organizational strategy and electronic methods of delivering products, services and exchanges in inter-organizational, national, and global environments. Information technology strategy and technological solutions for enabling effective business processes within and between organizations in a global environ-ment are considered.

TOPICS Electronic commerce economics, business models, value chain analysis, technology architectures for electronic business, supply chain management, consumer behavior within electronic environments, legal and ethical issues, information privacy and security, transborder dataflows, information accuracy and error handling, disaster planning and recovery, solution planning, implementation and rollout, site design, Internet standards and methods, design of solutions for Consumer Internets, Intranets and Extranets, EDI, payment systems, support for inbound and outbound logistics.

IS 2002.3–Information Systems Theory and Practice (Prerequisite: IS'02.1)

SCOPE This course provides an understanding of organizational systems, planning, and decision process, and how information is used for decision support in organizations. It covers quality and decision theory, information theory, and practice essential for providing viable information to the organization. It outlines the concepts of IS for competitive advantage, data as a resource, IS and IT planning and implementation, change and project management.

TOPICS Systems theory and concepts; information systems and organizational system; decision support; quality; level of systems: strategic, tactical and operational; system components and relationships; information system strategies; roles of information and information technology; roles of people using, developing and managing systems; IS planning and change management; human-computer interface; IS development process; evaluation of system performance; societal and ethical issues related to information systems design and use.

IS 2002.4–Information Technology Hardware and System Software (Prerequisite: IS'02.1)

SCOPE This course provides the hardware / system software fundamentals for various computer / network architectures used in the design, development and implementation of contemporary information systems. These concepts enable systems development personnel to explain tradeoffs in computer architecture for effective design. System architecture for single user, central, and networked computing systems; single and multiuser operating systems.

TOPICS Hardware: CPU architecture, memory, registers, addressing modes, busses, instruction sets, multi processors versus single processors; peripheral devices: hard disks, CDs, video display monitors, device controllers, input/output; operating systems functions and types; operating system modules: processes, process management, memory and file system management; examples and contrasts of hardware architectures, operating systems, basic network components and telecommunication devices for the implementation of information systems.

IS 2002.5–Programming, Data, File and Object Structures (Prerequisite: IS'02.1)

SCOPE This course provides an exposure to algorithm development, programming, computer concepts and the design and application of data and file structures. It includes the use of logical and physical structures for both programs and data.

TOPICS Data structures and representation: characters, records, files, multimedia; precision of data; information representation, organization and storage; algorithm development; programming control structures; program correctness, verification, and validation; file structures and representation. Programming in traditional and visual development environments that incorporate event-driven, object-oriented design.

IS 2002.6–Networks and Telecommunication (Prerequisite: IS'02.4)

SCOPE This course provides an in-depth knowledge of data communications and networking requirements including networking and telecommunications technologies, hardware, and software. Emphasis is upon the analysis and design of networking applications in organizations. Management of telecommunications networks, cost-benefit analysis, and evaluation of connectivity options are also covered. Students learn to evaluate, select, and implement different communication options within an organization.

TOPICS Telecommunication configurations; network and Web applications; distributed systems; wired and wireless architectures, topologies and protocols; installation, configuration and operation of bridges, routers, switches and gateways; network performance tuning; privacy, security, firewalls, reliability; installation and configuration of LAN and WAN networks; monitoring of networks; management of telecommunications, and communications standards.

IS 2002.7–Analysis and Logical Design (Prerequisite: IS’02.1)

SCOPE This course examines the system development and modification process. It emphasizes the factors for effective communication and integration with users and user systems. It encourages interpersonal skill development with clients, users, team members, and others associated with development, operation and maintenance of the system. Structured and object oriented analysis and design, use of modeling tools, adherence to methodological life cycle and project management standards.

TOPICS Life cycle phases: requirements determination, logical design, physical design and implementation planning; interpersonal skills, interviewing, presentation skills; group dynamics; risk and feasibility analysis; group-based approaches: project management, joint application development (JAD), structured walkthroughs; structured versus object oriented methodologies; prototyping; database design; software package evaluation, acquisition, and integration; global and inter-organizational issues and system integration; professional code of ethics.

IS 2002.8–Physical Design and Implementation with DBMS (Prerequisite: IS’02.5 and IS’02.7)

SCOPE This course covers information systems design and implementation within a database management system environment. Students will demonstrate their mastery of the design process acquired in earlier courses by designing and constructing a physical system using database software to implement the logical design.

TOPICS Conceptual, logical and physical data models and modeling tools; structured and object design approaches; models for databases: relational, hierarchical, networked and object oriented; design tools; data dictionaries, repositories, warehousing and data mining; database implementation including user interface and reports; multi-tier planning and implementation; data conversion and post implementation review.

IS 2002.9–Physical Design and Implementation in Emerging Environments (Prerequisites: IS’02.2 and IS’02.8)

SCOPE This course covers physical design and implementation of information systems applications. Implementation in emerging distributed computing environments using traditional and contemporary development environments.

TOPICS Selection of development environments and standards; software construction: structured, event driven and object oriented application design; testing; software quality assurance; system implementation; user training; system delivery; post implementation review; configuration management; maintenance. Multi-tier architectures and client independent design.

IS 2002.10–Project Management and Practice (Prerequisite: IS’02.7)

SCOPE This course covers the factors necessary for successful management of information systems development or enhancement projects. Both technical and behavioral aspects of project management are applied within the context of an information systems development project.

TOPICS Managing the system life cycle: requirements determination, design, implementation; system and database integration issues; network management; project tracking, metrics, and system performance evaluation; managing expectations of managers, clients, team members and others; determining skill requirements and staffing; cost-effectiveness analysis; reporting and presentation techniques; management of behavioral and technical aspects of the project; change management. Software tools for project tracking and monitoring. Team collaboration techniques and tools.

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